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THE JOURNAL OF THE NATIONAL DENTAL ASSOCIATION

1921

Evolution of the Periodontal Pus-Pocket —*Box*

Question of Dentifrices—*Kells*

Studies of Peridental Membrane, Cementum, and Dentin with Reference to Infections —*Skillen*

Food Accessory Factors in Relation to the Teeth—*Howe*

Crown and Fixed Bridge-Work—*MacBoyle*

Diagnosis of Periodontal Disease—*Bunting*

Acid Production by Streptococcus Viridans —*Grace and Highberger*

Psychology in Its Relation to Practice —*Rogers*

Denture Service Following Extraction —*Gillis*

What Shall We Tell the People? —*McGee*

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NATIONAL SOCIETY OF DENTURE PROSTHETISTS, BOSTON, 1920

Seated (Reading from Left to Right): Gillis, Wilson, Clapp, Monson, Gysi, Hall, Giffen, Stansbery.
Kneeling: Sears, Nichols, Lane, Bailey, Graham, Holaday, Owen, Horner, Nelson, Lowery, Campbell, Caughron, Smedley, Cross.
Standing: Williams, Hopping, Furnas, LaDue, James, House, McAfee, Tench, Brenner, McGrane, Peters, Holroyd.

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VOL. 8 AUGUST, 1921 NO. 8

Original Communications

THE EVOLUTION OF THE PERIODONTAL PUS-POCKET[1]

By HAROLD KEITH BOX, L.D.S., D.D.S., Ph.D., Toronto, Canada

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

ULCERATIVE pockets overlying cementum may be defined as the lesions produced by the establishment of infection in the cemental gingivae and pericementum, whereby, thru suppurative process, these tissues have been detached from the cementum. Dependent upon the amount and nature of the loss of tissue, ulcerative pockets may be classified into two main groups—the first, in which the lesion is confined to the cemental gingiva, and the second, in which extension of the ulcerative process has taken place into the pericementum. An understanding of pocket formation in dental periclasia is impossible without an adequate conception of the histological complex in which the pathological changes are initiated. The importance of the gingivae in their relationship to the pericementum, both in health and disease, necessitates the following short description of their minute anatomy.

The tissues of the oral cavity known as the gingivae include all the soft tissues which invest the cervical portions of the crowns and roots of the teeth, to the level of the crests of the alveolar process. The main bulk of the gingival

[1]Also issued as *Bulletin No. 1,* of the Canadian Dental Research Foundation, May 1, 1921.

tissue rests upon the crests of the alveolar process, and is supported by them. From these crests to the gingival line, the amelo-cemental junction, and attached to the cementum, is that division of these tissues known as the cemental gingivae. The cemental gingivae are attached to the alveolar crests by fibers of the periosteum and certain principal fibers which are inserted in the cementum.

Rising from the cemental gingivae and supported by them are wedge-shaped tissue extensions which encircle the enamel at the cervix. These are known as the marginal gingivae. By their contact with the enamel they form the so-called gingival crevice, the deepest portion of which is bounded by the first attachment of the cemental gingivae at the amelo-cemental junction.

The epithelium which covers the gingivae is of the stratified squamous type, and rests on a thin basement membrane. It differs from that of the gums, the tissue of which is continuous with the cemental gingiva and which covers the alveolar process, in that it becomes thicker and stronger progressively from a point approximately opposite the crest of the alveolar process to the crest of the marginal gingiva. A characteristic of the gingivae is the invagination into the epithelium of finger-like papillae of connective tissue. The distribution of the epithelium on the crevicular[2] surface of the marginal gingiva is an outstanding feature, because, as a rule, it is unusually thin. Occasionally breaks can be noticed in this lining, where the epithelium is absent, and, again, imperfect junctions of the crevicular epithelium with the cementum are frequently observed. These facts—its extreme thinness, the possible presence of breaks on the surface, and imperfect junctions—render this crevicular surface the weakest link in the chain of epithelial covering in the mouth.

The gingivae have an extremely rich blood supply, which is derived from the pericemental and periosteal blood-vessels, as well as those of the adjoining gums. The connective tissue of each papilla carries an arteriole which passes to its extremity, where it terminates in a capillary loop and returns as a vein. This circulatory apparatus is designed to carry nourishment to all the epithelial cells. It is commonly seen in the microscopic study of these tissues, that the cells separating the capillary loops from the saliva are very few in number.

The progression of the inflammatory process in the evolution of a pus-pocket may be classified into the following four stages: (1) early inflammatory reaction following the initial invasion of bacteria; (2) loss of some of the epithelial lining at the extremity of the gingival crevice, and the establishment of ulceration in the cemental gingiva; (3) progressive loss of tissue, and the formation of a pocket in the cemental gingiva; (4) extension of the pocket into the pericementum.

Bacterial invasion of the gingivae, in practically all cases except the phagedenic type, takes place from the gingival crevice thru the crevicular surface of the marginal gingiva. A microscopic examination of a large number of early lesions in the gingivae has demonstrated to the essayist that the great majority of infections occur at the base of the gingival crevice, where, thru imperfect junction of the epithelial cells with the cementum, or because of the extreme thinness of this defensive covering, the tissue underlying this area is not adequately protected. The earliest lesion which occurs following bacterial inva-

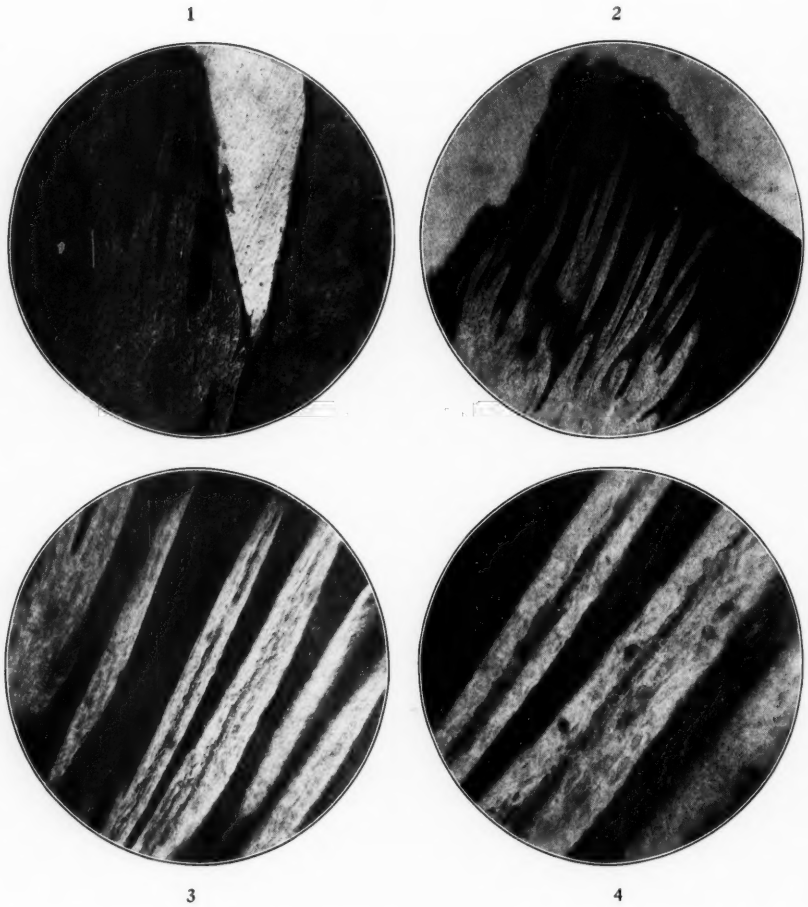
[2]Crevicular: adjective—relating to the gingival crevice.

sion is a minute area of small cell infiltration, the inflammatory reaction to the micro-organisms. Leucocytes escape from this area thru the thin layer of epithelium, and appear, along with desquamated epithelial cells, on the crevicular surface of the marginal gingiva.

When, thru progression of the inflammatory process, ulceration has been established at the base of the gingival crevice, after the necrotic epithelium is cast off, the attachment of the principal fibers of the cemental gingiva, at the gingival line, is involved. Due to the action of ferments liberated, either by the polymorphonuclear leucocytes or by bacteria, tissue solution takes place, resulting in the stripping of gingival tissue from the cementum and the formation of a small pocket. Penetration of this pocket into the deeper tissues, following further bacterial invasion, results in the complete loss of attachment of the cemental gingiva to the cementum, and in the establishment of ulceration and pocket formation in the pericementum. The soft tissues covering the denuded cementum present a surface which is in a state of constant inflammatory reaction. This varies within wide limits, depending upon the amount and nature of the injurious agents and on the severity and character of the injury. The cementum underlying the pocket and from which the soft tissues have been detached always presents a septic surface. This is due to the frequency of serumal deposits and to the retained ends of the principal fibers in the insertion layer.

The type of exudation from periodontal pockets is commonly known as pus, and is made up of leucocytes in abundance, serum in varying quantities, fibrin usually of scant amount, and living and dead bacteria. Of the leucocytes, the polymorphonuclear predominates, altho endothelial leucocytes and lymphocytes may be fairly abundant.

It must not be overlooked that when a pus-pocket is present in the pericementum, it is usually but a part of a more involved pathological complex. While the stages in the histo-pathology of the actual pus-pocket are essentially the same in all cases, the formation of a pus-pocket in the pericementum is a phenomenon preceded in many cases by much more complicated and deeper changes than simple gingivitis. The ideal requisites for rapid and deep pocket extension are alveolar resorption, lowered resistance in all or part of the pericementum, and gingivitis. Lowered resistance in the pericementum is frequently brought about by excessive mechanical function of the teeth or, upon the other hand, by their disuse.



Figs. 1-4.—In Fig. 1 is shown the gingival crevice and the attachment of the marginal gingiva to the tooth. Note the extremely thin protective covering of stratified squamous epithelium on the crevicular surface of the marginal gingiva. In Fig. 2, showing the marginal gingiva, note the extremely thick covering of epithelium on the outer surface. Into this epithelium are projected long finger-like extensions of the underlying connective tissue. Fig. 3 is a high magnification of the connective tissue extensions into the epithelium. Each papilla supports a circulatory system comprising an arteriole, capillary loop, and returning vein. The blood is carried by the arteriole to the end of the connective tissue papilla, passing there thru the capillary into the returning vein. Fig. 4 is a very high magnification of two connective tissue papillae. In one may be seen quite distinctly the arteriole and returning vein lying side by side.

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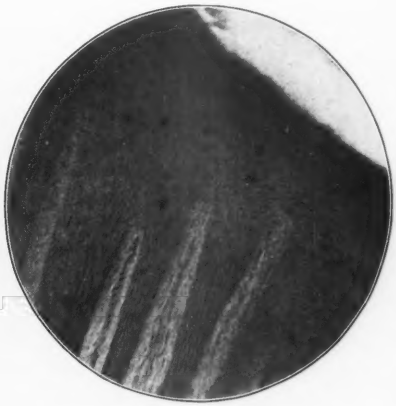

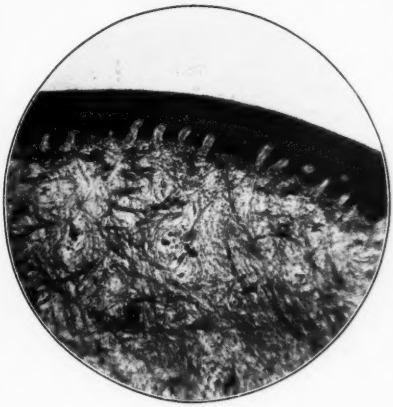

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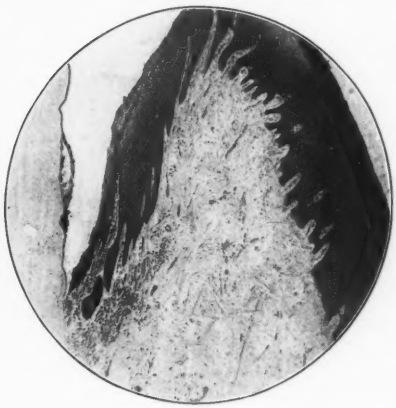

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Figs. 5-8.—Fig. 5 is a good example of a high magnification of the capillary loop at the extremity of one of the connective tissue papillae. The bulk of the tissue shown here is made up of epithelial cells. Fig. 6 shows the very thin layer of epithelium which covers the capillary loops and protects the blood stream from the oral fluids. This arrangement, which is ideal from the standpoint of nourishment of the epithelium, becomes a weakness in certain infective processes, evidenced in phagedenic gingivitis, and accounts, in part, for the rapid extension of ulceration. Fig. 7 is that division of the soft tissues overlying the alveolar process to its crest known as the gums. It demonstrates the interlaced mat of connective tissue fibers which holds this tissue to the process. Fig. 8. Infection of the gingivae, as a rule, takes place at the extremity of the gingival crevice. A defective junction of the epithelium on the crevicular surface of the marginal gingival with the tooth, creates an easy avenue for bacterial invasion at this point. Here is shown an example of an imperfect junction of the epithelium with the tooth.

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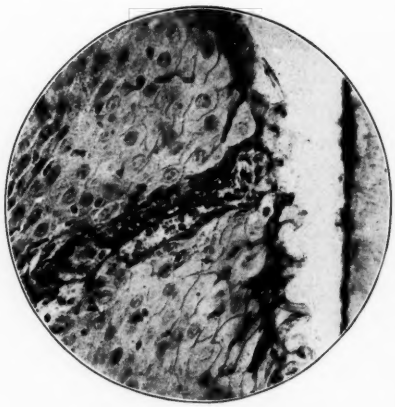

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Figs. 9-12.—Fig. 9. Occasionally, besides the weakness of the gingivae to infection, just described, viz.: an extremely thin epithelial covering on the crevicular surface, and an imperfect junction, a third one is noted. In this class, breaks in the crevicular epithelium are found, in which the underlying connective tissue is devoid of epithelial protection. Two such breaks may be seen in Fig. 9. Fig. 10 is a very high magnification of one of the breaks described in Fig. 9. Note the blood vessel extending almost to the gingival crevice. Clumps of bacteria on the tooth surface just opposite are demonstrated. In Fig. 11 another such break in the epithelial covering is evidenced. Again note the blood vessel passing to the gingival crevice. Fig. 12 shows several breaks. Such histological defects must, in certain cases, be regarded as factors in gingival infection.

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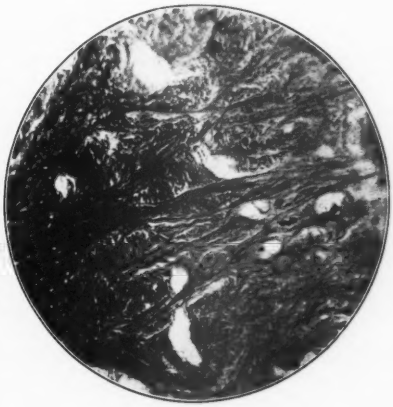

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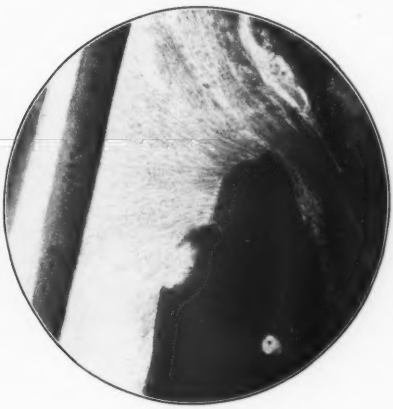

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Figs. 13-16.—In the marginal gingiva is found the first group of principal fibers having their insertion in the cementum. They pass outward from the cementum and extend toward the crest of the marginal gingiva. The function of this group is to hold the marginal gingiva in close apposition with the enamel surface. Fig. 13 demonstrates this grouping of fibers. In Fig. 14 is shown the second group of principal fibers, which passes mesio-distally from tooth to tooth thru the cemental gingiva. It helps to hold the contact points of the teeth together, and is known as the "trans-septal" group. Fig. 15 shows a large, well-defined grouping of fibers, which originates in the cementum and passes to its attachment in the crest of the alveolar process. It is termed the "alveolar crest" group, and serves to prevent rotation of the tooth in its alveolus. In Fig. 15, this group is sharply defined. Note the line of demarcation between the dentin and the cementum, where, in the preparation of the section, the cementum has been separated from the dentin. Fig. 16 is a higher magnification of the same group and shows in detail the course of its many fibers.

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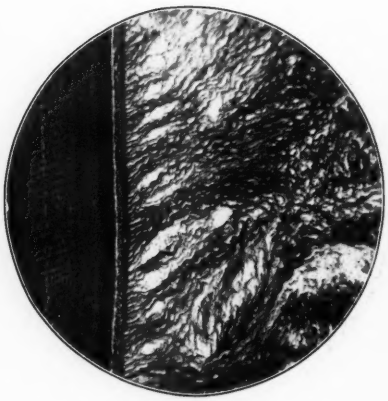

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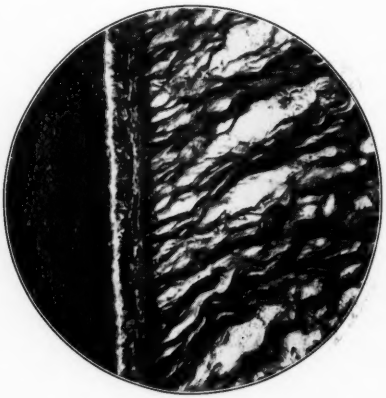

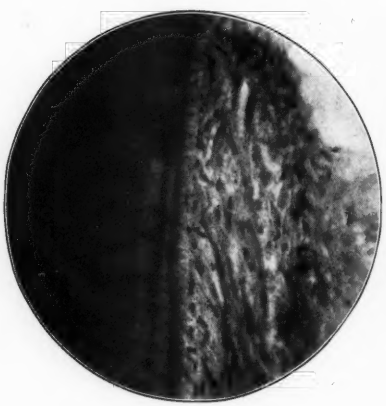

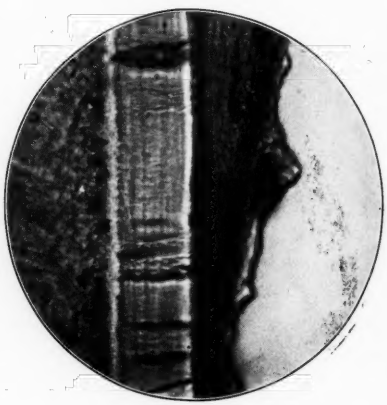

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Figs. 17-20.—Apical to the "alveolar crest" group, are found the "horizontal" and "oblique" groups, which pass from the cementum to the wall of the alveolar process. The "oblique" group is by far the larger, and constitutes the bulk of the pericementum. The fibers, from their attachment to the process, pass in a slightly apical direction to the tooth. This grouping is shown in Fig. 17. In Fig. 18 these fibers are shown highly magnified. Their function is to support the tooth during occlusal strain. Fig. 19 demonstrates the insertion of the principal fibers of the gingivae and pericementum into the cementum. The cementum, upon the loss of the principal fibers in pocket formation, presents a pitted surface which affords an ideal lodging place for bacteria and their products. In Fig. 20 is shown the cementum underlying the average pus-pocket. This cementum is practically homogeneous. It differs from the apical cementum in that it usually contains no cement corpuscles. It is extremely thin, from a clinical standpoint, and in many cases is about the same thickness as a human scalp hair. A section of this cementum with some attached pericementum is here shown.

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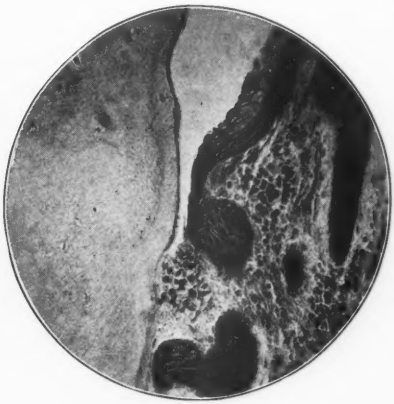

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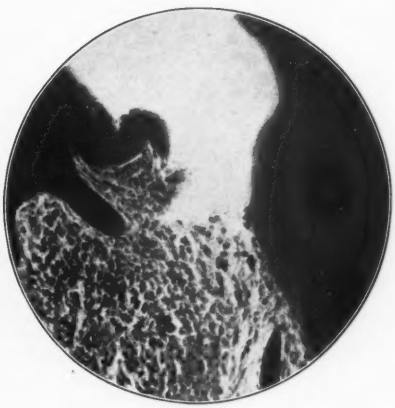

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Figs. 21-24.—Fig. 21. Bacterial invasion of the gingivae, as a rule, takes place at the basal extremity of the gingival crevice. In Fig. 21, a faulty junction of the crevicular epithelium with the tooth is shown, and in the gingival tissue immediately underlying it, may be noted a minute area of small cell infiltration, the inflammatory reaction to the invading microorganisms. This is the earliest lesion which occurs in the evolution of a pus-pocket, and cannot be demonstrated clinically. In Fig. 22 a higher magnification of the foregoing lesion is shown. The imperfection of the junction of the epithelium with the tooth is plainly evidenced. The infiltration is of the plasma cell type. In Fig. 23 a condition is shown which may be regarded as a second stage of inflammatory progression in the evolution of a pus-pocket. It will be noted at once that the inflammatory infiltration is more extensive than that shown in Figs. 21 and 22, and that some of the epithelium at the extremity of the gingival crevice has been lost. Superficial loss of tissue lying between the remaining epithelium and the tooth structure is taking place, the condition being one of ulceration. Fig. 24 is a high magnification of the inflammatory process occurring in the tissue lying between the epithelium and the tooth, as shown in Fig. 23. It is clearly shown that some loss of tissue has taken place, and the remaining superficial tissue is in a state of ulceration.

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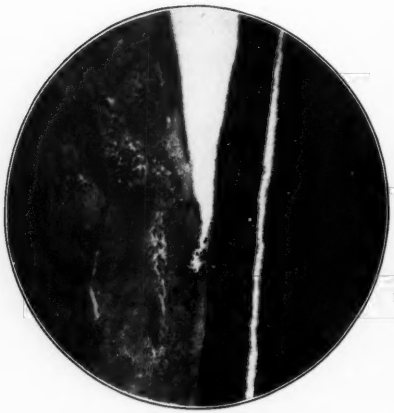

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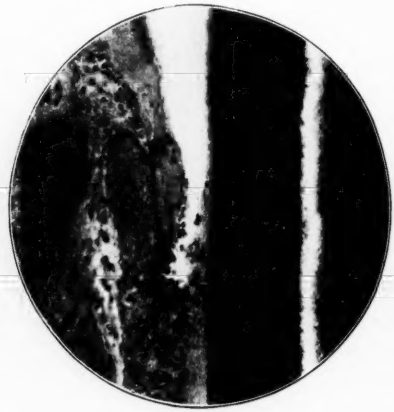

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Figs. 25-27.—In Fig. 25, the third stage in the evolution of a pus-pocket is demonstrated. The ulcerative process has resulted in the partial denudation of cementum, and in the cemental gingiva a small pocket has been formed. Note, in this case, that extension of the ulcerative process is not proceeding along the cemental surface; and also the evidence of inflammatory reaction in advance of the pus-pocket. Fig. 26 shows a high magnification of the pocket just described. Note that the pocket extends from the crevicular epithelium, which may be seen near the top, to the surface of the ulcer. In Fig. 27 is an example of the fourth stage in the pathological evolution of a pus-pocket. Loss of tissue, denudation of cementum and pocket formation, have progressed into the pericementum. All the soft tissue facing the cemental surface is in a state of ulceration.

THE QUESTION OF DENTIFRICES

By C. EDMUND KELLS, D.D.S., New Orleans, Louisiana

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

WEBSTER'S new *International Dictionary* defines a dentifrice as "a powder, paste or liquid used in cleaning the teeth." I believe it can be safely stated that it is now realized that one of the greatest factors, if not the greatest single factor, in the general health of a person from infancy thru to old age is the condition of the mouth, or, in other words, the teeth. Barring unusual cases, the condition of the teeth usually depends in a great measure upon the care taken of them, consequently we arrive at the conclusion that the care of the teeth from the moment of their eruption is of paramount importance. Therefore the question of dentifrices, that is if dentifrices of any kind are needed, should be considered one of the most vital questions of the day.

The Dentifrice of Today

As we look thru our daily papers and our magazines, striking advertisements of dentifrices constantly meet the eye. There are undoubtedly some dentifrices upon the market that were originally prepared in good faith, because there was a necessity for them; but, undoubtedly, most of the recent products in this direction were originated solely for the purpose of separating an unwary public from its money. Let us not believe for a moment that any of these manufacturers and exploiters could have any ulterior motive, with the result that the public, and, most unfortunately, many dentists as well, are educated upon this subject solely by the advertisements just mentioned.

The history of most of these products undoubtedly is about as follows: The idea is first conceived by some "Mr. Wallingford" that millions of people brush their teeth, and these millions will use some dentifrice. Then why not get into the game, originate some dentifrice, advertise it, and sell it to them? Nothing is easier. The next idea is to endeavor to have some novel and catchy feature— a *feature* mind you, not necessarily a fact—about the dentifrice for which the public "will fall." Once the manufacture is begun, the dental profession is sampled, and the education of the public is commenced by startling advertisements in the papers.

What of the profession? I believe I can safely say that 95 per cent of the dental profession has not the slightest idea as to what a dentifrice should or should not contain; that probably this 95 per cent adopt first one and then another of these dentifrices as fast as they are placed upon the market, irrespective of their composition, and as they are induced to do so by their silver-tongued representatives.

Let each one ask himself the question, "What do I really know of the dentifrice that I am using and that I recommend to my patients?" and see what the answer will be. As a matter of fact, why should any one of us really know anything about dentifrices? Who has

educated us upon the subject? What are our colleges doing for prophylaxis and dentifrices? Practically nothing I should say. Or if they are doing something for the subject of dentifrices, it is so smothered up and kept so dark that probably even the students do not appreciate their efforts.

I have before me the bulletin for 1920-21 of one of the leading colleges of the country—probably no other school outranks it. I find that it lists forty-five professors, lecturers, and instructors, eight assistants, and one examiner. These fifty-four men are scheduled to lecture upon all the regular topics usually taught in a dental college, including English, drawing, jurisprudence, and ethics. The examination of patents requires the services of a D.D.S., while an M.D. is a special research investigator. All this, and never a mention of prophylaxis or dentifrices. All this array of talent for everything except prophylaxis—prophylaxis, the very keystone upon which the arch of modern dentistry should depend, is completely ignored. Yet it is not possible for the dental graduate to leave that college with a proper appreciation of dentifrices and their value. It may be possible that under the topic of oral hygiene the colleges do pay more attention to the question of dentifrices than I have given them credit for.

If any one other than Dr. Pickerill has advanced any ideas upon the subject, who is he? Is he not some one who has placed some dentifrice of his own upon the market. And upon what does he base his knowledge of the subject? Now and then we find a dentist who imagines that there is a necessity for another dentifrice, or who possibly would like additional revenue; he therefore concocts a formula of his own, manufactures it, and furnishes it to his patients and to the public. Right or wrong, that man is to be commended. He at least has some ideas of his own, even if they are wrong.

Not much was heard upon this question of dentifrices until 1912, when Dr. Pickerill[1] published a brilliant work and his theories were accepted by some apparently without giving them serious consideration. When this work on *Prevention of Dental Caries and Oral Sepsis* made its appearance, it gave to many men a new trend of thought. Pickerill's ideas, from their very nature, must have been purely theoretical. In fact, he admits in his very first chapter that his conclusions were drawn a priori, and a priori conclusions should be impossible for a research worker. I say his ideas must have been purely theoretical, because at the time his book was published he was still a young man, had been in practice but a few years, and thus could not possibly have had any clinical experience, especially as he was not located in one place for even a short time. Thus it was impossible for him to have followed up his patients in order to note the results of his practice. However we may disagree with him upon all his main points, we must admit that he has given the profession a most interesting work, and those who have not read it have missed a great deal. To quote from this work: "We are therefore driven to the inevitable conclusion that alkaline dentifrices and mouth washes for the prevention of dental caries must be abandoned, and we further conclude that some substance which is a salivary stimulant should be used in order to promote and educate the activity of the salivary glands. Now it has also been conclusively proven that the best substance for this purpose are acids and there is not the slightest reason why the best should not be used in this case."

Upon reading such a dogmatic state-

[1]H. P. Pickerill, M.D., Ch.B., M.D.S., (Birm.) L.D.S. (Eng.). *The Prevention of Dental Caries and Oral Sepsis.*

ment, the question at once arises, "Who is Pickerill?" The answer has already been given—a wonderfully brilliant and earnest worker, but a young man of theories, without any practical clinical experience. Evidently Dr. Pickerill's attention was drawn to two facts; the one, that dental caries were just as prevalent at that time, if not more so than they were one hundred years before; and second, that alkaline dentifrices had always been used to combat the disease. Both of these statements are undoubtedly true, but he then jumps to the conclusion that the "treatment was radically wrong," and therein lies his mistake. Dental caries are prevalent today, not because of the use of alkaline dentifrices, but rather in spite of them. As a matter of fact, caries of the teeth have increased among countless thousands who never used any dentifrice whatever. Dental caries may have increased among another group of countless thousands who used alkaline dentifrices, but how did they use them? What proportion of the more educated classes, who even pretend to take care of their teeth, do so with any degree of thoroness? The mere fact that the normal condition of the mouth is either neutral or slightly alkaline and that the introduction of an acid into the mouth induces an increased flow of an alkaline saliva is proof positive that the acid is harmful. Nature, when normal, is continuously on guard, and whenever anything harmful gains entrance into the body, she at once endeavors to fight it off.

Pickerill advocates the idea that a dentifrice should be a salivary stimulant. With all due deference to him and his following, I do not hesitate to affirm that a salivary stimulant is the very last ingredient a dentifrice should contain. Where is the dentist who cannot clean and polish the teeth in the upper arch of any patient when he can keep this operative field comparatively dry and free from saliva, better than he can the lower teeth, which in some patients are practically flooded with saliva all the time? The slimy nature of the saliva renders it most difficult, or even impossible, to polish the teeth. Such being the case when the dentist is trying to clean the teeth of a patient, why do not the same conditions obtain when the patient is trying to clean his teeth himself? They certainly do.

Any experienced dentist will indeed insist that the less saliva there is in the mouth during the process of brushing the teeth the better for the patient, and that instead of a dentifrice containing an acid fruit juice or any other stimulating substance in order to increase the flow of saliva, it should, if possible, contain some ingredients to produce just the reverse effect, to reduce the flow of saliva. This acid theory of Pickerill's was the one great idea that has inspired some of our more recent creations in the way of dentifrices, and their sponsors would endow these acid fruit juices with superhuman intelligence, a trait that Dr. Pickerill did not discover. We all know by our own experience that acid fruit juices destroy the teeth and we need no postgraduate course upon the subject. It is no unusual occurrence for a patient to state that the teeth are all "on edge" and exceedingly sensitive. The first inquiry is as to diet, and we invariably find that acid fruits, oranges, grape fruit, and lemons, have been recently used in unusually large quantities. A change of diet is recommended, and also alkaline mouth washes, and in a week or two the mouth is again in normal condition.

How many of us but have seen the literal *wrecks* that schoolgirls have made of their teeth by eating lemons and sugar or salt. But when these fruit acids are incorporated into these dentifrices they become endowed with superhuman power, because the manufacturer tells us—prints it in fact—that all these acids

do is to eat away the plaque, and the instant the plaque is dissolved—not a fraction of a second sooner nor a fraction of a second later, but just at that instant—and the acid is ready for business upon the enamel, it stops and awaits the arrival of the alkaline saliva, the flow of which it has stimulated, to neutralize it; thus the surface of the tooth is saved. Here we have an enamel-destroying agent eating its way down to the enamel and then ceasing work. One would think such a statement too absurd for belief, and yet this theory has gained a foothold where it greatly surprises us.

Professor Gies, of Columbia University, New York, unfortunately has taken up this idea of the educated acid fruits; he is advocating their use, which is much to be regretted because his opinion should carry some weight, but let us not forget that Professor Gies[2] is not now, and never was, a dentist. Let us view this, not from a theoretical standpoint, but from a common-sense point of view, that is, from that of the practical and experienced dentist. We know that acid fruit juices will dissolve the enamel. We know, and no one will deny it, that every time an acid fruit juice is taken into the mouth it will attack the enamel if in sufficient quantity and given sufficient time. Knowing these facts, we can readily see the danger of acid fruit juices used in a dentifrice two or three times a day, when the manufacturers themselves admit that they rely upon the alkaline saliva to come along at the right instant to neutralize them, and thus prevent them from doing harm. What if the neutralizing agent misses connection? This theory appears absolutely ridiculous because I believe it is reasonable to assume that many a time the acid will get a chance to attack the enamel before it becomes neutralized. Pickerill himself, however, never did make any such ridiculous claims, but believes the contrary, as the following quotation will prove: "Undoubtedly there is a short time during which the acid remains unneutralized, but this is not sufficient to cause any effect except upon the occlusal surface." This is merely a statement of opinion, and the wonder is that the acid will affect the occlusal surfaces only and not the others. As a matter of fact, I see no reason to believe that it will not affect the others as well, and from clinical evidence I believe it does. We also find the following statement (p. 232). "There are, however, two dangers to guard against—those of using an acid either too weak or too strong. If an acid be used in too weak a solution it will do more harm than good. If an acid be used in too strong a solution it may have precisely similar effect." These admissions from the father of the acid dentifrice theory would spoil the effect for me, even if I had been slightly inclined toward it.

To summarize, then, on the acid dentifrice proposition, be it powder, paste, or liquid. Dr. Pickerill says there is undoubtedly an interval of time between the use of an acid and the flow of the neutralizing alkaline saliva, during which time the acid could attack the enamel; also that the acid must be of a certain definite strength, for if weaker or stronger than this definite dilution it will do more harm than good, but he does not give us the faintest idea as to what the correct strength should be. Imagine, if you can, the thoughtful intelligent dentist using an acid in the mouth which its sponsor distinctly states must be of some unknown strength, for "if weaker or stronger" it will do more harm than good. We note the absence

[2]William J. Gies is editor of the *Journal of Dental Research* and a member of the Biochemical Department of Columbia University, College of Physicians and Surgeons. He is author of the article on "Studies of Dentifrices," in the *Journal of Allied Dental Societies*.—Editorial Note.

of these quotations from the advertisements of these acid dentifrices.

Let us write it down, then, in capital letters, that all those who use acid dentifrices—powders, paste, or liquids—do so at the risk of their teeth, we have Dr. Pickerill's written word for it, and he originated the acid dentifrice.

Let us cite an analogous case. A large room, the floor of which is covered with shavings and other combustibles, is provided with an automatic sprinkler system. A fire is started, but before it has gained any appreciable headway the sprinkler operates and the fire is extinguished. The next day another fire is started, and again it is promptly extinguished. Again the next day, and the next, and so on. Every time the fire is started, it automatically starts the flow of water and it is extinguished, but note the fact that before it is extinguished it has burned up some of the shavings. By starting the fire often enough all the shavings will be burned up, notwithstanding the fact that the sprinkler system puts out the fire each time. This exact process occurs in the mouth. Every time the harmful acid is introduced into the mouth, nature neutralizes it by an undue flow of alkaline saliva, but before that can be done it has accomplished some little harm.

Gum-Chewing

I thoroly disapprove of exciting an undue flow of saliva during the brushing of the teeth; however, if for any reason an unusual flow is desired, it can best be excited by chewing gum. While I do not consider gum as a dentifrice, I believe that the chewing of gum for three minutes after meals can, in some instances, prove very beneficial. For children who bolt their food, for example, the chewing of gum for three minutes afterward not only cleanses their teeth very effectively but also gives the teeth that exercise which they would have received had their food been properly masticated. This, of course, induces a flow of saliva which might prove of benefit in assisting digestion.

Personal Experience

I started the use of alkaline dentifrices and the use of lime water coincident with the beginning of my practice, just forty-two years ago. For forty years, I myself was a consistent user of these alkaline agents, and during the forty years I lost one perfectly good third molar and had about five fillings inserted.

During our recent critical period I received a dentifrice, free. I said to myself, "Why waste this good material, why not 'test' it out as requested?" This dentifrice containing an acid was diametrically opposed to all my practice and teachings of forty years, but appreciating the fact that it cost nothing, and that it was wicked to throw it away, I used it. At the end of the year my dentist found and filled four cavities; three of which were in the incisors which were carefully brushed and flossed every day. Forty years of alkaline dentifrices and five fillings; one year of acid plaque-digesting dentifrice and four cavities, and in a man of my age! Never again will I stray from the path blazed away forty years of satisfactory clinical results of alkaline dentifrices. Of course, this may have only been a coincidence, but why did none of the various members of my family have such a coincidence while sticking to their alkaline dentifrices? Just another case of the automatic sprinkler putting the fire out after some damage had been done!

An Important Question

The question of dentifrices cannot be settled by scientific laboratory experiments. It must be decided upon clinical evidence. No question of greater importance to the people at large can be brought before this association than that of a suitable and safe dentifrice, and the

question of the advisability of alkaline or acid preparations should not be decided by ex parte testimony, but by some thoro and exhaustive tests. I am not prepared to say just how these tests should be carried out, but it would appear to me that it would be possible to use certain institutions for that purpose. Possibly either Boston or Rochester with their magnificient Forsyth and Eastman clinics could handle such a proposition, for, undoubtedly, it is a man's size job.

Let us suppose an institution with, say, two hundred children. Their teeth are placed in good condition and their mouths are supposedly to receive the same daily routine attention. One hundred are to use acid mouth washes five times a day, rinsing their mouths for a certain number of minutes each time, and to brush their teeth with acid dentifrices twice a day. One hundred to do the same with alkaline preparations. Carry this on for, say, two years, during which period the teeth of each child should be examined every thirty or sixty days and carefully charted. This series of experiments should be carried on in various parts of the country at the same time.

As I said before, this is a "man's-size job" and it will cost money. Are there not some men in the profession capable of handling it? Could not this association raise the necessary amount? Could it be used to any better advantage? Who will say that prevention of decay is not more desirable than reconstruction? Who will say that the prevention of decay does not lie largely in the hands of the patient? Who will say that patients should not obtain their instructions for this work from their dentists? Who is there that believes that dentists as a class have been doing their full duty to their patients in this matter?

I was taught the use of alkaline dentifrices and began my practice with the use of alkaline dentifrices and have advocated alkaline dentifrices ever since. Year by year I saw the good results obtained by their use, and I became more and more convinced that alkaline dentifrices were the dentifrices to use. As an indication of my interest in my patients' welfare, and in an endeavor to do my duty by them, I have given them printed cards of instructions for possibly thirty years or more. While the wording has been changed from time to time, the gist of the instructions has always been the same. Herewith are listed copies of these instruction cards:

CARE OF THE TEETH

Upon rising, the mouth should be thoroly rinsed with an alkaline mouth wash, preferably lime water, Glyco-Thymoline or Borine.

After breakfast waxed floss silk or tape should be passed between the teeth (being careful not to snap it down hard upon the gums, which would injure them), after which the teeth should be most carefully, thoroly and *correctly* brushed, preferably as follows:

A suitable brush should have been prescribed by the dentist. Upon this dry brush place a very small quantity of some approved *alkaline* dental cream, preferably Kolynos, S. S. White's, or Colgate's, and cover it bountifully with precipitated chalk. Or if preferred some *approved* alkaline tooth powder, such as Lyon's, can be used. Rinse the mouth thoroly and then brush the teeth carefully, thoroly, and *properly*.

After luncheon, when possible, floss silk should be used, and the mouth most thoroly rinsed with a wash—otherwise with clear water.

After dinner repeat the above.

Just before retiring the teeth should be again thoroly and correctly brushed and flossed or preferably carefully taped as in the morning and the mouth thoroly rinsed with an alkaline wash.

Nothing short of the above constitutes good care of the teeth, when the mouth is in a healthy condition.

If the gums have a tendency to bleed, or there is extreme sensitiveness of the teeth, other treatment may be necessary, which should be directed by the dentist.

Tooth picks should not be used, but if insisted upon, only fine quills.

Wooden picks should never be used.

C. EDMUND KELLS

LIME WATER

Lime water is one of the best of mouth washes. Should be made at home and used *profusely*.

Place about a cup full of unslacked lime in a half-gallon bottle, fill with water, cork well and shake several times during the day.

Upon the following morning, pour off most of the water, which contains the washings of the lime, and throw away.

Fill again with water, and shake well. When settled, decant carefully into smaller bottles, to be kept upon the toilet stands for daily use. Then fill the jar with water again, and shake well, and you have another jar full of lime water. Used in this manner this amount of lime will furnish lime water for six months or more, if the jar is kept well corked.

For use, add a sufficient quantity (say a table spoon or two) to a half-glass of water so that it can be slightly tasted, and rinse the mouth most thoroly. If lime water is used too strong it will affect the mouth unpleasantly.

Keep the bottles well corked.

C. EDMUND KELLS

CARE OF CHILDREN'S TEETH

The proper care of children's teeth is of the utmost importance, and while it is a fact that the temporary teeth will be lost, it is nevertheless true that their neglect may bring about more serious results than equal neglect of the permanent teeth.

As soon as the first tooth is well erupted, the use of the mouth rag should be supplemented by that of a soft brush, and with this and clear water the teeth should be carefully brushed every day.

Immediately upon their full eruption, the surfaces which are in contact with each other should be polished daily by means of suitable floss silk.

When the child has reached an age at which it will not swallow everything that is put into its mouth, precipitated chalk should be used upon the brush once a day.

The mouth should be well rinsed with dilute lime water, upon rising, after meals and just before going to bed.

Later on, cleanse the teeth as follows: Rinse the mouth well. Place a *little* of a good dental cream upon the *dry brush*, and cover the brush bountifully with precipitated chalk and brush as taught.

If the teeth were perfectly formed and the occlusion correct, this should keep them in perfect condition, provided always that the proper diet has been insisted upon and the child taught to properly masticate its food.

Little children should not be allowed to eat candy or other sweets. If there is any agent which will ruin infants' teeth more quickly and more seriously than condensed milk, it is not known to the writer.

Unless there is evidence of such necessity, the child need not be taken to the dentist until it is two years and a half old. At that age the teeth should be carefully examined by him, and again every three or four months.

However, if at any time dark stains accumulate upon the teeth near the margin of the gums, they should be polished off. It is absolutely essential that all surfaces be kept clean and bright.

The decay of these temporary teeth insures the child untold discomfort and pain, and usually interferes with the proper eruption of the second set. Owing to their nature it is most essential that all cavities should be filled in their incipiency.

The extraction of any temporary teeth before the period for the eruption of their permanent successors usually interferes with the proper eruption of the second set.

The first teeth of the permanent set to appear are the first molars, which should erupt at about six years of age and *before any of the first set have been lost*. These teeth should be kept under a watchful eye, as they are very prone to decay.

If at this age the arches have not grown, and all the front teeth so separated that one or two thicknesses of blotting paper cannot be put between them, the second set is sure to be crowded and irregular. In such cases, possibly the arches should be expanded and the necessary space made to accommodate the larger teeth of the second set. The family dentist should always be first consulted regarding this condition.

While some children may contract unfortunate habits, notwithstanding the most strenuous efforts being made to prevent their doing so, the permitting of the child to suck its thumb or fingers, or the giving it a "pacifier," is simply criminal, as most serious results must follow.

The harmfulness of mouth breathing should be recognized and the necessary steps taken to cure it.

During the eruption of the second teeth, they should be given special care, and should be examined at least twice a year, and cleaned and polished as often as necessary. Cavities should be filled in their incipiency.

If the family dentist were charged with the duty of sending for the child at stated intervals, the chances of neglect upon the part of the parent would be minimized.

To brush the teeth carefully, thoroly and properly is quite a trick and cannot be well taught by the absent method. The family dentist should personally explain this to the child and give advice as to the style of brush to use.

Eternal vigilance is the price of good teeth in the child as well as the adult.

C. EDMUND KELLS

No one who has spent his life in such a splendid profession as that of dentistry can fail to note with alarm the adoption by the profession of some fad which all of his experience convinces him is bad for the patient. Forty years and more of careful consideration and experience in prophylaxis and dentifrices—forty years and more of clinical evidence—convince me that the use of acid paste, powder, and wash must be detrimental to the teeth, and their use today is largely a fad, mostly among the thoughtless.

Undoubtedly the larger part of the dental profession, and the public as well are absolutely "at sea" upon the question of dentifrices, and as the subject never has received the attention it deserves at the hands of the profession the time has come for this association to take hold of the subject and give it the prominence it deserves. What we desire to be informed upon by some real authority so that we can speak to our patients with confidence upon the subject is:

1. Can a dentifrice, be it powder, or liquid, destroy the harmful germs to be found in the mouth and not injure the teeth themselves?

2. Can any dentifrice do more than cleanse the teeth and mouth?

3. In view of the fact that a normal mouth is either neutral or slightly alkaline, and that acids injure the enamel, should or should not a suitable dentifrice be either neutral or slightly alkaline and thus in harmony with nature, rather than acid, which must necessarily act as a counter-irritant?

4. Should not the dental colleges have a separate chair for the teaching of prophylaxis and the study of dentifrices?

5. Should not manufacturers be discouraged from using misleading advertisements?

This is what we dentists should know. This is what our patients should know, and the only solution of the problem lies in the hands of the National Dental Association, which should appoint a Commission to investigate the subject and work out some suitable plan for its solution.

DISCUSSION

G. Walter Dittmar, Chicago, Illinois: Dr. Kells has presented a forceful and convincing argument in favor of alkaline dentifrices and I cannot disagree with him. There is, however, much confusion and difference of opinion on this subject and after having heard this excellent paper there may still be some who are of the opinion that Dr. Pickerill is right, or that the arguments of the manufac-

turers of dentifrices containing acid are right. To me Dr. Kells's findings are nothing more than good common sense, tho they may not prove that his conclusions are correct. The care of the mouth and especially the teeth is a subject that has received comparatively little attention from a preventive or prophylactic standpoint. It is true that pathological conditions have been studied and the science and art of restoring lost teeth and lost tooth structure has developed almost to perfection, but the science underlying the prevention of most dental diseases is as yet almost entirely in its infancy. The ravages of dental diseases and oral sepsis can never be successfully combatted until genuine and thoroly scientific means are formulated to prevent these diseases. Dr. Kells is emphatically right when he says that prophylaxis is the keystone upon which the arch of modern dentistry should depend. Preventive dentistry is the type of dentistry that our profession must study more carefully and finally provide effective means for combating that great menace to health, comfort, and aesthetics—dental caries.

Quoting from my President's Address[3] read before the Illinois State Dental Society last March I said: "We are confronted with the appalling fact that fully 95 per cent of the mouths of all children of school age are diseased.

"We also know that mouth infections lead to serious systemic disorders, both nervous and organic. It is also a fact that clean teeth do not decay, and while most oral diseases are amenable to treatment, it is plainly evident that prevention of dental disease is the goal which our profession should strive to obtain. The archenemy of the teeth is dental caries. If this disease could be prevented the greater part of the inflammatory and suppurative disorders which so often result in alveolar abscesses and chronic suppurative pericementitis or so-called pyorrhea alveolaris, and their train of systemic infections, would never occur. The logical means to prevent this almost universal disease would be to supply the human organism with the proper antibodies, or else a stimulant which would cause the system to produce these antibodies. Whether this be done by a properly prepared and balanced diet supplying the system with the needed vitamines, or by the inoculation of live or dead bacteria, chemicals or what not—it is my earnest hope that some day some remedy can be administered to the child, which will produce an immunity to dental caries.

"It is evident from reliable statistics obtained from many sources that from 3 to 5 per cent of children possess a natural immunity to dental caries.

"We, as dentists, know that in most mouths an immunity gradually established itself. We also know that mouths that have become practically immune may become at times violently susceptible again, due, no doubt, to some metabolic disturbances. In turn the disease in these mouths may again gradually lessen and cease. One fact is evident and that is that some element, some substance antidoting dental caries, is possessed from infancy by a very small percentage of humanity, and that in a very large percentage of the remainder this element or substance is gradually developed. *What is this substance? This antibody? And how can it be produced?* Surely some scientifically trained mind will solve this problem and earn the distinction he will so richly deserve, namely be classed with the world's greatest benefactors."

Russell W. Bunting, Ann Arbor, Michigan: Dr. Kells has touched on the very significant phase of dental practice. It is indeed a unique situation that regarding dentifrices, which are so important a part of our armament, we have so little accurate information and are so dependent on others for production. For the most part our dentifrices are manufactured by various commercial houses over which we have no control. The formulas of their preparations are proprietary and secret and are subject to change without notice. Certain well-established pharmaceutical houses are making every effort to attain an excellence and uniformity of their products, while many small concerns are using very crude and inefficient methods in the production of preparations which are variable and inferior in quality. It is unfortunate that in the selection of the particular dentifrice to be used and recommended to patients the dental profession is guided not by an accurate knowledge of the composition and action of each but rather by the advertising propaganda of the manufacturers or the personality of their representatives.

We all agree with the essayist that this condition of affairs should not be. It certainly is high time that a concerted effort should be made by the profession to standardize the manufacture of dentifrices and to publish more accurate information in regard to them. It is very probable that we shall always be forced to depend on the larger and established pharmaceutical houses for the wholesale manufacture of dentifrices, just as we are dependent on the dental manufacturers for our instruments and other equipment. But we can and should insist that these products be made

[3]Published in the *Illinois State Dental Society Proceedings, 1920.*

according to certain standard and that their particular qualities shall be published.

Before we can do this, however, we must first determine what a good dentifrice is, what it should contain, and how it should be compounded. Until we ourselves discover and agree as to the desirable qualities in a dentifrice we cannot with good grace criticize the manufacturer who is making as good a preparation as he knows how to make. This is clearly our problem and when we have worked it out we shall find that the manufacturers for the most part will be very willing to conform their products to well-established facts concerning them.

The most important qualities of dentifrices may be said to be abrasiveness, saponification, reaction, lodgeability, and taste. Considerable variation is seen in the abrasiveness of the common oral preparations. We published *(Jour. Nat. Dental Assoc.,* 1915, p. 247*)* photomicrographs of nearly thirty of these preparations showing the wide variation in type of gritty substance which they contained. However, the action of these abrasives is very largely modified by the amount of soap and other substances with which they are incorporated. Just recently we have completed a machine designed for accurately testing the abrasive qualities of powders and pastes. The tests are made by applying the various dentifrices to tooth enamel with a brush, 200,000 strokes being given under fairly uniform conditions. From the tests so far made it appears that there are three grades of preparations, namely, those that are markedly abrasive, those which are moderate abrasives, and those which show little or no abrasive action. Herewith is a list and we feel fairly confident in regard to the particular class to which the articles belong.

Abrasive	Medium	Bland
Carmi-pyo	Lyon's powder	S. S. White's paste
Euthymol powder	Lyon's paste	Chlorax
Pepsodent	Colgate's paste	Kolynos
		Pebeco
		Carmi Lustro
		Prophylactic
		Listerine

However, we might go out next week and buy a sample of any one of these, and find they have moved over to another class. We have no assurance that the manufacturers from week to week and month to month make them uniform. Some were originally very strong abrasives, but today they are not, possibly because some of the manufacturers are waking up to the situation and modifying their product to meet the present condition. It is our intention to undertake a large series of tests with this machine during the coming year by which not only the manufactured products will be checked but also the action of each ingredient of which they are composed. In regard to the reaction of dentifrices we find ourselves in accord with Dr. Kells when he says that clinical practice does not support the universal use of acid preparations. There are certain types of cases in which the saliva is thick and mucinous and the mouth is habitually unclean. In them acid washes and dentifrices often materially assist in cleansing the mouth and maintaining oral hygiene. But in those cases in which the saliva is thin and the teeth are naturally self-cleansing the use of acid mouth preparations will frequently result in hyperacidity and an acceleration of dental caries.

Nor is it certain that strongly alkaline dentifrices should be universally adopted. Following the use of lime water the mucous membranes are frequently irritated, and to many patients its use is decidedly distasteful. Except where a decided acid or alkaline is clearly indicated it seems more reasonable that mouth preparations be either neutral or slightly alkaline.

This is a biological problem with which we are confronted. Since various mouths differ as to their physical condition and physiological function, so, then, should the aids which we prescribe for their prophylaxis vary according to the needs of the case. We cannot, therefore, hope to arrive at any one universal formula for a dentifrice, but rather should certain types of formulas be presented from which preparations of standard abrasiveness, saponification, acidity or alkalinity, etc., may be compounded. In this manner may we select and obtain a proper dentifrice for each individual case.

We agree with Dr. Kells in his premise that the question of dentifrices is an important problem which the dental profession must solve. To this end concerted effort should be made by all those who are equipped to study these preparations in the light of their relation to oral prophylaxis. This study, however, must be systematized and correlated or there will be much duplication of methods and a loss of efficiency. There must be a centralized committee which will have as its function the enlistment of the research workers in the various dental colleges, the direction of the research, and the correlation and publication of the results obtained. We join with the essayist in urging that definite action toward the establishment of such a commission in the National Dental Association be taken.

Justin D. Towner, Memphis, Tennessee: During the past several years the subject of dentifrices has been given serious consideration by Dr. Edwin D. Watkins, of Memphis, a physiological chemist of many credentials,

and myself. While we were not disposed to consider all dentifrices bad, the further our research progressed the more evident it became that the state of affairs regarding the composition and exploitation of many such preparations was deplorable. This convinced us that the majority of the dental profession, who have given little or no thought to this subject, and the unsuspecting public need protection in respect to the composition of mouth toilet preparations.

Unbiased and impartial experiments led us to the conviction that a dentifrice for the average mouth should be simple in composition, slightly alkaline in reaction, and a mild salivary stimulant. There will always remain the necessity for correcting excessive alkalinity or acidity in a small percentage of mouths, and for this purpose more specific prescription must be made. There should be, however, a safe and sane preparation for use in the large majority of cases.

The liquid dentifrice, generally known as a mouth wash, so far proven generally acceptable by laboratory tests and clinical evidence is a 1 per cent solution of benzoic acid and sodium borate in an isotonic sodium chloride with water soluble menthol.

Bacteriological tests show that the effect of this preparation on the more pathogenic bacteria, such as the influenza bacillus, streptococcus hemolyticus and streptococcus non-hemolyticus, is markedly germicidal within a period of less than five minutes, yet it is so non-irritating that it can be put into the conjunctival sac without either causing pain or irritation. In addition to this, the product was placed in the hands of a competent commission for further investigation, the report of which has been unanimously favorable.

While this procedure, which is now being followed in the working out of a dentifrice in powder and paste form, is recited in support of Dr. Kells's contention that this is not a commercial but rather a professional problem, and as such should be put into the hands of a commission, the result obtained thereby is an affirmative answer to his question: Can a dentifrice destroy harmful germs in the mouth without injury to the teeth?

As evidence of personal accord with the essayist's suggestion that a distinct chair of prophylaxis should be established in all dental schools, and in proof of my efforts in this direction, it is only necessary to state that in the organization of the College of Dental Surgery, University of Memphis, during the summer of 1909, a special professorship, devoted to the teaching of mouth hygiene, prophylaxis and pyorrhea, was created by the faculty and taught by me. (Applause.) Later this institution was merged with the University of Tennessee, carrying with it this chair which has since been maintained. As teacher of this branch of allied subjects for nine years I endeavored to stress the importance of each and mold the whole into a foundation upon which all conservative dentistry should stand. The course as outlined for the four-year curriculum designates mouth hygiene for the first-year students, oral prophylaxis for the sophomores, pyorrhea and kindred conditions for the juniors. In this way students get an idea of the fundamental principles of hygiene and its important basic relation to dentistry when they first enter school instead of having it gradually dawn upon them later. In the second year they have oral prophylaxis, which, added to their previous instruction in mouth hygiene, gives them a more definite and at the same time a broader conception of true professional service. In the third year they have the two previous courses focused upon restorative processes, especially the treatment of pyorrhea and other diseases of the investing tissues. With the three-year course as outlined here the student has the opportunity to practice the application of these principles, under the guidance of competent instructors and demonstrators, in the second semester of the junior year and during all of the senior year. This brief outline is indicative of a logical course to pursue, and, so far as Dr. Kells's suggestion is concerned, intimates that hygiene should be coupled with prophylaxis.

There can be no doubt as to the necessity of such a fundamental course in all dental colleges. The future of our profession depends upon the recognition of the vital importance of, and definite training in, preventive practice. I see no reason why we cannot go on record as favoring and actually requesting the establishment of a special chair for the teaching of mouth hygiene and oral prophylaxis, or rather preventive dentistry, in all dental colleges. It seems to me that such action is in perfect accord with the purposes of this association as it encourages more perfect organization, stresses the importance of hygiene and prophylaxis, and makes for more efficient public service.

It occurs to me that the scope of work being done may be broadened and its influence for good greatly enhanced if its name could be so amended as to include the words oral prophylaxis after that of mouth hygiene. I see no need of a separate section on oral prophylaxis, as suggested in the paper, when all such matters may properly come before this body. While oral prophylaxis is a big subject within itself, it is so allied with that of mouth hygiene as to make the two interdependent. It seems, then, that the name of this section could very properly be amended so as to be designated,

organization, mouth hygiene, oral prophylaxis and public service. Even a better solution would be to designate this section as that of preventive dentistry.

Wallace Seccombe, Toronto, Canada: I must take issue with the suggestion that gum-chewing is not a bad thing. To my mind gum-chewing is a most pernicious habit and a mental distraction for both young and old. If I mistake not, gum-chewing was suggested by Dr. Kells as something that might take the place of, or that might follow, the improper mastication of food, with a view to correcting the harm done by the bolting of food. But I submit that it would be much better for the dental profession to take the position that the important question is the mastication of food, rather than to suggest that the evils following the lack of proper mastication might be overcome by the artificial operation of gum-chewing.

Gum-cheming is a prevalent habit because nature calls insistently for adequate exercise of the muscles of mastication. If we properly masticate our food, if we give our masticatory apparatus proper exercise, the bad habit of gum-chewing would not be so prevalent. It is because we bolt our food, it is because of the quick lunch habit (which we have more or less acquired in these days of "rush") that nature is calling for that exercise which we are not supplying. The result is the gum-chewing habit.

I feel that as a profession we should take a position opposed to all of these substitutes for "nature's way." I believe that with correct food, properly prepared and thoroly masticated, we would not be required to resort to artificial means for the prevention of dental disease, and it is this phase of the question that the dental profession should stress. There is a place for the dentifrice as a toilet necessity. We all certainly use a dentifrice for the teeth just as we use soap and water for the face, but *the dental salvation of the human race will never be found in any of these artificial methods of prevention*. Dentifrices, liquids, pastes, gum-chewing are all artificial, man-made methods and are toilet requisites but they cannot be expected to overcome the difficulties which we encounter because of our wrong methods of living.

The tendency of the average person is to chew gum for long periods of time. This causes an undue flow of saliva between meals and the saliva is impoverished at meal time, resulting in digestive disturbances. This fact is borne out by clinical observation, notwithstanding the advertisements of chewing-gum manufacturers to the contrary.

Dr. Kells (closing): I do not believe in gum-chewing as a practice, but possibly he did not hear me say to chew gum for *three minutes*. Sometimes a bright little child will say to me in the office: "Dr. Kells, is it well to chew gum?" and the parent will say, "Yes, chewing gum is all right." But I say: "If you will chew it three minutes, it will do you good. If you chew it three and one-fourth minutes it is dental destruction."

The doctor says we should not follow artificial means, but we are all living artificial lives. If we were not, we would not call in doctors to preserve our lives. If we masticated our food we would not need anything, but if we do not masticate our food we will save ourselves trouble by chewing gum for three minutes.

Lime water is not good if used in strong solutions, but in a weak solution it will not attack the mucous membrane of the mouth.

HISTOLOGICAL AND PATHOLOGICAL STUDIES OF THE PERIDENTAL MEMBRANE, CEMENTUM, AND DENTIN WITH REFERENCE TO INFECTIONS

By WILLIAM G. SKILLEN, D.D.S., Chicago, Illinois

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

EXCLUDING unusual traumatic lesions, it is generally accepted that there are two types of inflammation and suppuration occurring in the peridental membrane. One has its beginning, apparently, at the gingival line of the tooth following a gingivitis, the other, at some point within the membrane following the death or removal of the pulp.

The latter are usually considered apical in location and are so named. In a great many cases, and insofar as subsequent tissue involvement occurs about the apex in others, this usage may not be incongruous. Foramina are, primarily, the pathway by which infection from the pulp reaches the investing tissues. These are not limited to the apical region only and may well be the source of inflammation and suppuration in other parts of the membrane, rendering the term "apical" inadequate.

In presenting the subject announced, it will not be my purpose to enter into a detailed description of all the changes that take place during the course of these lesions. I shall limit myself chiefly to a consideration of the structure and physiology of the teeth and the investing tissues, which appear to be related to the extension and treatment of these diseases.

In the light of recent work alone, which has been done on the tissues of the tooth, indicating their permeability not only to nutritional fluids but to infective products, and its consequent bearing on the treatment of suppurative conditions about the roots, it is to be hoped that this discussion will be of interest and profit.

The Investing Tissues

In the longitudinal section thru tooth and investing tissues, we note the dense layer of epithelium of the exposed surfaces of the gum and gingivae. Here the cells are compact, with the surface layers more or less hardened, thereby better resisting friction and affording protection to all of the underlying structures. Lining the inner surface of the gingivae, i.e., the surface which rests against the enamel or in the gingival space, is an epithelium that is less compact, exhibiting no stratum corneum and offering less resistance to infection. Deeper down the solid mass of fibers of the peridental membrane, attached to the cementum, pass out into the gingivae or to the bone of the alveolar process. Lying upon the surface of the cementum, between the ends of the fibers, may be found cementoblasts which are the formative cells of the cementum, as on the surface of the bone of the alveolar process may be found osteoblasts with a like function. Coursing thru the membrane, about midway between the ce-

mentum and the alveolar process, are groups of blood vessels and nerves. For the most part these run parallel to the long axis of the tooth. To the outer walls of these blood vessels and nerves are attached the minute lymphatic spaces which drain the gingivae and peridental membrane. (15, 17).

The general principles upon which the lymphatics functionate should be remembered. Serum is delivered to all of the connective tissues from the minute capillaries of the blood system to serve as their nutritive fluid. This tissue fluid of lymph, added to by the products of metabolism of the tissues, is gradually drawn into, chiefly, lymph spaces and channels, to be carried finally thru the lymphatic system. In conjunction with the blood system, the lymphatics afford a drainage for the tissues. According to one writer, the latter are purely scavenger (11, 18, 19).

We may say that no connective tissue is without its drainage system, but not until Schweitzer (17), substantiated by Noyes and Dewey (15), demonstrated the presence of these vessels in the peridental membrane and pulp could we say positively that those structures were drained by lymphatics. As these accompany the blood vessels we must note the distribution of the latter.

The blood supply of the peridental membrane is threefold. Vessels pass thru the gum tissue on the outside of the bone of the alveolar process, arching over the crest of the process, to pass down thru the membrane toward the apex of the root. A second source of supply is received from one or more vessels which enter the membrane about the apex, and splitting up into six or more branches, they enter the pulp or pass thru the membrane toward the crown of the tooth. The third group consists of vessels which pass thru the bone of the alveolar process to the membrane on the inner surface. (13, 8).

The lymphatic channels accompany these vessels, the flow of the lymph being toward the apex. Those which have their beginning under the epithelium lining the gingival space and which drain this part of the gingivae and the tissues about the neck of the tooth, pass down thru the membrane toward the apex (15). Those which drain the gum tissue and the outer surface of the gingivae pass down on the outer surface of the alveolar process toward the apex (16).

Pathology

If the course of the lymphatics and the clinical picture be compared, it is interesting to note the correlation between them. The fact that most of these vessels run parallel to the long axis of the root explains the symmetry of the pus pockets. If the majority of the vessels encircled the tooth, the infection would be carried around the root more rapidly than toward the apex, and the pockets would be broad and shallow rather than deep and narrow.

In those infections caused by deposits of salivary calculus which are located in the gum (14, 1), the inflammatory reaction appears to follow the lymphatics attached to those vessels which course thru the gum on the outside of the alveolar process, supporting the evidence that this form of deposit does not cause the formation of pus pockets along the side of the root.

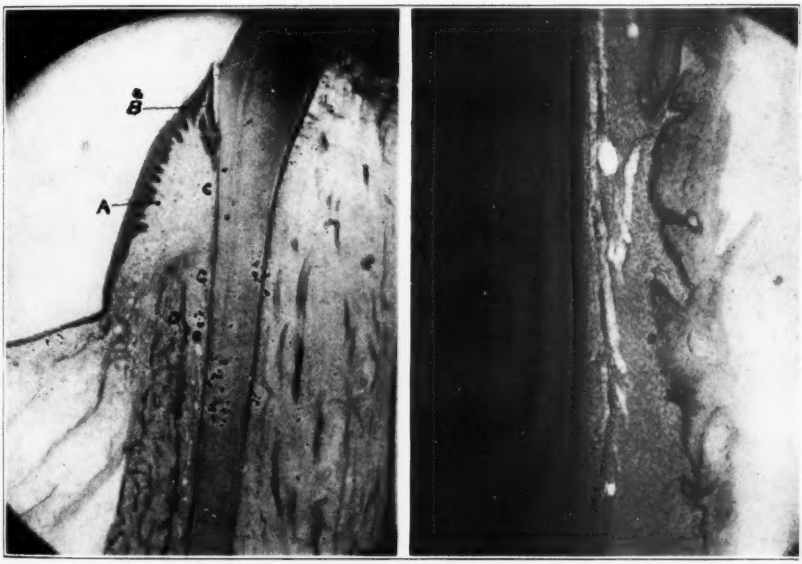
In the earlier appearance of the inflammatory process arising from salivary calculus irritation, the outer border appears to be the portion of the alveolar process primarily affected; while in those irritations affecting the tissues of the gingival space, and which travel down thru the membrane, the inner or membrane surface of the process is first attacked (14).

The view that these vessels are controlling influences in the spread of inflammation about the teeth, as in other parts of the body, is further substantiated. In diseases occurring at the apex, tissue destruction does not take place

gingivally to the infected area. The vessels, as they leave the tooth apex, pass down and out thru the bone of the jaw—the lymph flow is apically. Wider destruction of tissue arising from infection in the pulp may be accounted for otherwise, as was indicated in the opening paragraph.

The primary inflammatory infiltration, as pointed out by Hatton (6), is located about the vessels, always in advance of tissue destruction. The first changes occur in the interfiber or interstitial tissue (14), that is, in the slight amount of connective tissue that normally fills the spaces between the principal fibers which pass from the cementum to the bone and gingivae, and that also surrounds the blood vessels and nerves. This tissue is increased in amount and takes on an inflammatory character. Inflammatory reaction is evidenced in the blood vessels by an accumulation of round cells and a thickening of their walls.

The subsequent changes that take place appear to be the result of the inflammation following the course of the vessels. The principal fibers, encroached upon more and more by the thickening of the interstitial tissue, are pushed aside and gradually degenerate. The inflammation following the vessels into the alveolar process causes its removal. Here two processes may be involved, depending upon the location of the inflammation, a pathological one and a physiological one. It must be remembered that the function of the alveolar process is one affording attachment to



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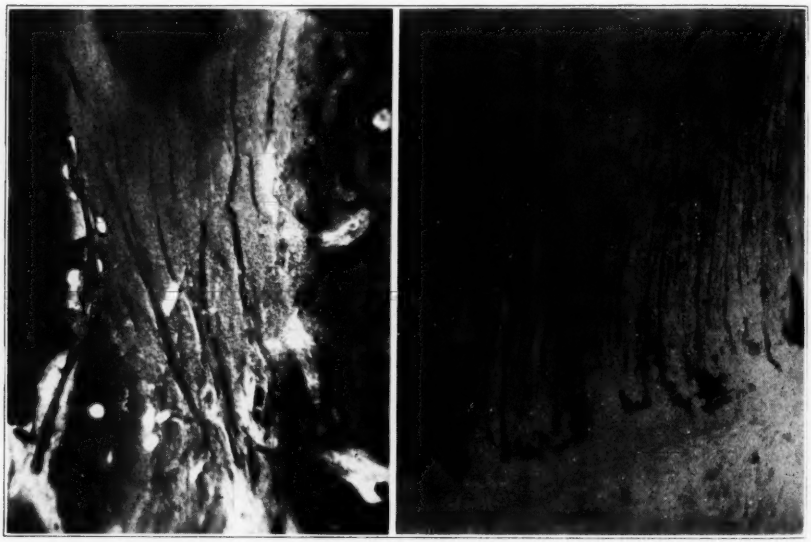
Figs. 1, 2.—Fig. 1, the investing tissues: *a*, gum, *b*, gingivae, *c*, peridental membrane, *d*, alveolar process, *e*, vessels; Fig. 2 shows the general direction of vessels in a longitudinal section of peridental membrane.

the fibers of the peridental membrane. This is removed when these fibers are cut off by the inflammatory process, and it is natural to expect its removal by physiological absorption in the way it occurs following the extraction of a tooth. When bone involvement occurs at the apex of a tooth, the bone absorption would probably be purely pathological, as this is not a part of the alveolar process. Eventually, union of infected areas takes place, resulting in a large area of inflammatory issue. Fibers cut off from their circulation and deprived of nutrition by occlusion of the vessel walls die, and suppuration follows with the formation of a pocket or abscess cavity. Into the pocket so formed, the epithelium encroaches, keeping pace apparently with the further deepening of the pocket until it appears to completely line it (6). The cementum is left denuded and exposed to the action of the infective products.

Cementum and Dentin

To what extent the cementum or the dentin or both tissues are involved by suppurative processes occurring in the pulp or the investing tissues is of course a problem the answer to which depends upon several factors, i.e., their permeability, the relation in which they stand to one another in the matter of structural continuity, and the length of time they are exposed to penetrating substances.



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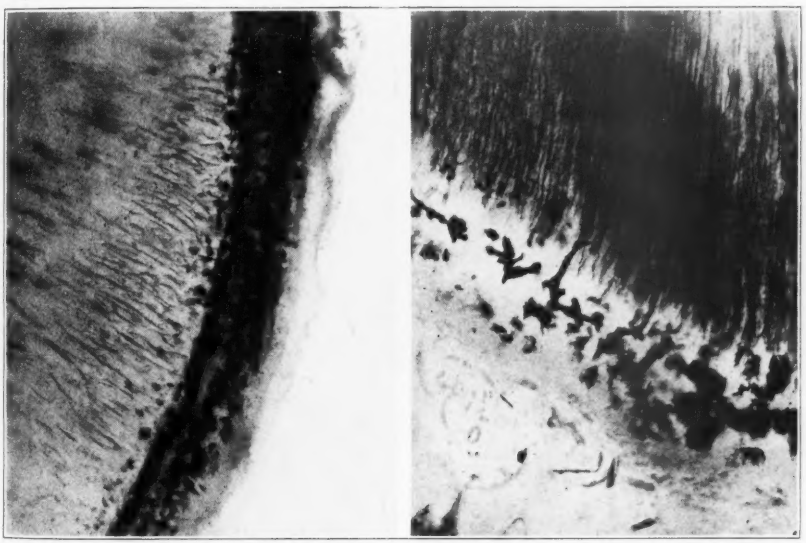
Figs. 3, 4.—Fig. 3 shows vessels passing thru bone at apex (*a*) of tooth; Fig. 4 shows tubule termination in gingival cementum. Decalcified section.

Recent work on these tissues which discloses more clearly and emphatically the structure of the granular layer and its relation to dentin and cementum, indicated a closer continuity between cementum and dentin than has heretofore been realized (21, 22).

In the gingival region the cementum

is thin, averaging about sixteen microns or less—a fraction of a millimeter (8, 10, 13). It is usually free of lacunae, which do not appear until the middle or the apical portion of the root is reached. They are quite frequently found in the cementum in the bifurcation of multi-rooted teeth. Innumerable imbedded fibers of the peridental membrane are, however, noticeable. These form a series of one or more bands in which the fibers are frequently so closely packed that very little of the intervening cementum matrix may be seen. Frequently these bands are in close contact with the granular layer, which lies internal to them, or with the dentinal tubules, which penetrate to them. The granular layer is sometimes quite extensive, but more often thin in the gingival region, widening out as the apex is approached. It is composed, apparently, of spaces with which the dentinal tubules anastomose, or, partly, of the tufted endings of the tubules themselves. In the apical region it becomes complicated by the appearance in it of canal and lakelike spaces, anastomosing, on the one hand, with the lacunae and canaliculi of the cementum and, on the other, with the tubules of the dentin. This is seen so often that it is safe to consider it the rule rather than the exception.



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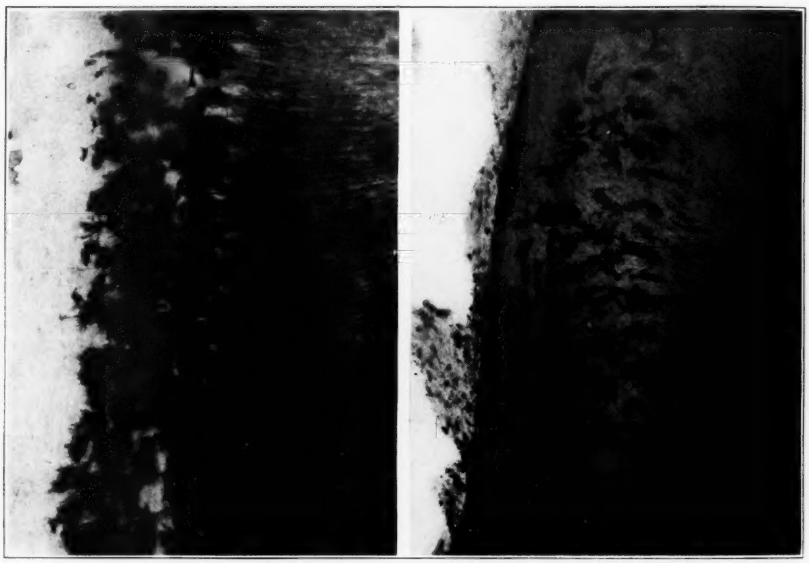
Figs. 5, 6.—Fig. 5, gingival cementum. Tubules and imbedded fibers intermingled. Decalcified section; Fig. 6 shows canal-like anastomosing terminations of tubules. Decalcified section.

The manner in which the staining of the tissues has occurred would indicate their permeability to surrounding fluids, slowly to be sure, as the process of staining is a long one (22). Isotonic fluids would probably penetrate faster. Permeability to the stain would indicate an ability on the part of nutritional or other fluids from the surrounding tis-

sues to penetrate these tissues to the same extent.

A study of these tissues so stained arouses interesting speculation. Doubt as to their penetrability by nutritional fluids alone, especially the cementum, has been indicated by at least one writer (10). It is conceded that there is a lymph flow thru bone, which to a certain extent is similar in composition to cementum, the anastomosis of the canaliculi permitting its penetration. In these specimens, all the lacunae and canaliculi of the bone have been stained and brought into strong relief. Furthermore, areas similar in location to those which Noyes and Dewey indicate as the position of the lymphatics, in the peridental membrane, the pulp, and the mandibular canal have become impregnated by the staining fluid. Whether or not what occurs in the staining of these tissues is due to the presence of lymph in the tissues cannot be stated at this time. There has appeared, during the course of this work, some slight evidence that an alteration in the normal content of the tissues, whatever that may be, affects the staining of them.

The permeability of the tissues alone, however, is important, for the apparent pathway which exists between dentin and cementum may not be sufficient in some instances to permit of the passage of infective organisms themselves, the ability of the lymph to penetrate would enable their toxins to pass to the tissues and either maintain a septic area or set up an inflammation.



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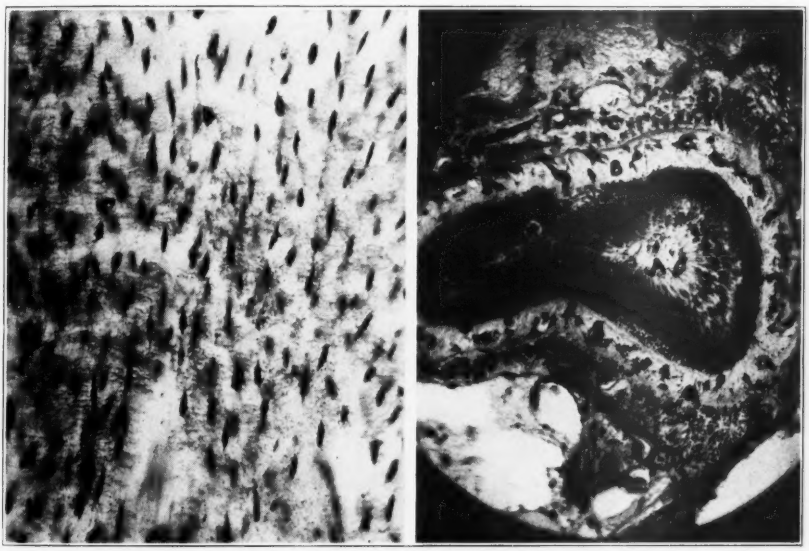
Figs. 7, 8.—Fig. 7, Tissue complex, near bifurcation. Decalcified section; Fig. 8 shows more regular arrangement. Granular layer and clear layer absent. Decalcified section.

Others have apparently demonstrated the permeability of these tissues (2, 3, 8). Damlos in his work (4) obtained

cultures of streptococcus from both dentin and cementum, to a culture of which they had previously been subjected for three or four days. Marshall (12), in his experiments on rats with vital stains, altho unable to obtain a passage of the stain between the dentin and cementum, has noted a diffused staining of each, attributing this to the passage anything about it, follow as a rule, suppurations occurring at the gingival.

A word might be said regarding multiple foramina, for, tho these have been shown by various workers in different ways and substantiated by serial sections of teeth to be present very frequently in the roots, note of them is seldom made in connection with trans-



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Figs. 9, 10.—Fig. 9 shows effect of stain on bone of the alveolar process. Decalcified section; Fig. 10 shows effects of stain on *a*, the tooth, *b*, the peridental membrane, *c*, bone of alveolar process. Decalcified section.

of fluids from the vessels of the peridental membrane and the pulp into their respective tissues.

Clinically there is evidence that would bear out Marshall in his assertion that there is no exchange of fluids between the dentin and cementum (12), barring accessory foramina. The loss of the pulp, even by suppuration, does not always cause an involvement of the tissues of attachment; neither does pulp infection, at least as far as we know ference of infection or in treatment. These canals are characteristically more numerous in the apical region of the root but may be found quite frequently at the bifurcation of multirooted teeth or in other parts of the root. One specimen in our collection, shows a rather large canal at the middle of the root passing at right angles to the length of the tooth, straight from pulp to membrane. Large numbers of these canals contain blood vessels as well as lym-

phatics, as Noyes and Dewey have demonstrated (15).

Undoubtedly these canals readily enable infection to travel thru the tissues and probably account for those wider destructions of tissue about the root than would occur if a single canal were the general characteristic (20). As heretofore pointed out, infection does not travel gingivally—the flow of lymph is apically.

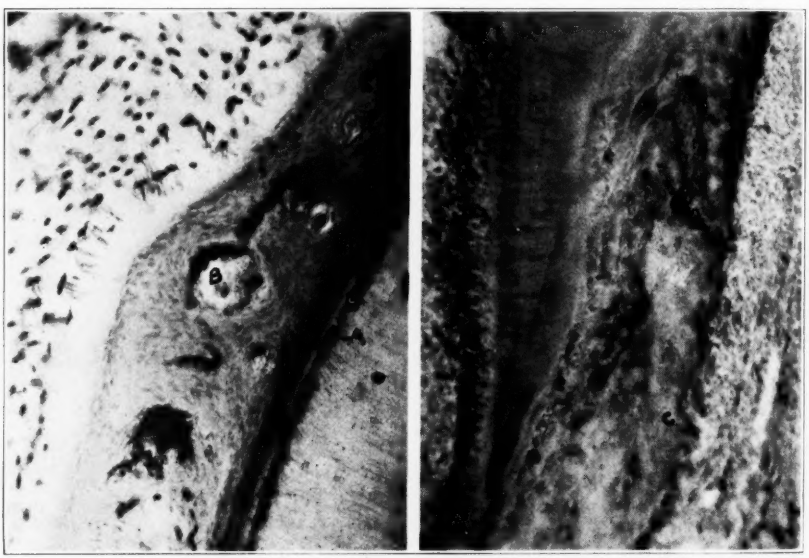
W. Clyde Davis (5), in noting that these canals are, apparently, obliterated by deposits of cementum after pulp removal, but before inflammation sets in, may have accounted for a large number of the seemingly successful treatments of root-canals. The average method of treatment is not such as would eradicate all these focal areas.

Remarks

From these considerations we may draw the conclusion that beyond a doubt infective materials may penetrate the cementum from the peridental membrane, or the dentin from the pulp, but, barring accessory foramina, the question of the passage of infection from one tissue to the other, thru dentin and cementum, must still be held in abeyance.

Given perfection in the form of treatment, there is no justification at the present time either for libeling the pulpless tooth "dead" or for its wholesale extraction.

Let me emphasize that this work is the only one, as far as I know, which reveals a sufficiently recurrent and definite pathway by which, at least, infec-



11 12

Figs. 11, 12.—Fig. 11 shows effects of stain on the tissues; *a*, granular layer, *b*, vessels in peridental membrane. Gingival region. Decalcified section; Fig. 12, structure of cementum (*c*) on developing root of a dog's tooth. Decalcified section, hematoxylin and eosin.

tive toxins may pass from one tissue to the other. Realistic as it is, I do not believe that the evidence is sufficient. If Dr. Davis is right, in that canals may be occluded by deposits of cementum, and treatment is such that it will thoroly render aseptic and occlude the pulp chamber, canals, and tubules, extraction is not indicated in every case of pulp involvement. Especially is this so when the pulp is not affected by suppuration.

It is evident that the cementum receives its nourishment from the peridental membrane; therefore pulp removal does not devitalize this tissue whose function is one of attachment. Furthermore, it may well be that nutritional fluids penetrate the dentin from the cementum and thus maintain a certain vitality in this tissue after pulp removal, expunging one more argument that the tooth becomes a foreign body on the removal of the pulp. Conversely, of course, a proof of this would indicate that infective products could pass from the dentin to the peridental membrane. Treatment, then, would have to be such as to make infective products invalid or the only recourse would be extraction. Results apparently hinge almost entirely on treatment.

On the other hand, however, when suppuration does occur within the peridental membrane and the cementum has been exposed for a time to its toxic products, there is sufficient evidence that they penetrate the cementum—the degree unknown—making it incompatible with the overlying tissue. The possibility or reattachment thus being precluded suggests the desirability of eradicating these foci of infection by the removal of the root end, as has been the modus operandi in these cases, and, in the others, the removal of the overlying tissue as recommended by Black (1).

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DISCUSSION

Russell W. Bunting, Ann Arbor, Michigan: In his paper your essayist has outlined the basic histologic characteristics of the borderland which lies between the tooth and the surrounding tissues. Inasmuch as the solution of many of the problems with which we are concerned today lies within this field the presentation which has been made is very a propos and worthy of careful consideration. As we consider the subject of infection both within the tooth and immediately without we are repeatedly brought back in our analysis to the question, What is the function of the cementum, does it protect the tooth from the entrance of infectious material from without, does it protect the surrounding tissues from infectious process in the pulp?

As your essayist says, there is no doubt but that infectious organisms or their products may pass in either direction thru the accessory foramina unless they be closed by thrombosis on the pulpal side or by hypercementosis on the outside. But these foramina are for the most part confined to the apical third of the root, while in the remaining two-thirds of the root the integrity of its surface is dependent on the specific qualities of the cementum with which it is covered, barring the occasional presence of an accessory foramina. If then the cementum were perfectly pervious, like the dentin, and an open communication between it and the dentin existed we might expect that infectious processes in the pulp would quickly spread to all parts of the peridental membrane and conversely that all peridental infections would readily invade the dentin and pulp.

Clinically we see that this does not usually occur. In many instances highly putrescent pulps produce no apparent effect on the surrounding peridental tissues. Their infectious organisms are hermetically sealed within the pulp canal by the closure of the foramina and the imperviousness of the cementum. So also do we see the great prevalence of gingival and peridental infections, which if allowed to enter the tooth would result in wholesale death of pulps. Were this true the troubles of a dental practitioner would be greatly magnified over those that he now has.

Experimentally and from a laboratory standpoint numberless attempts have been made to force stains thru the dentin and cementum from the pulp canal, but with the exception of the escape of fluids at the opening of canals they have failed. In the recent experimentation with AgNo3 in root-canals it has been noted that the silver salt will completely permeate the bulk of the dentin but that on the periphery and just beneath the cementum there appears to be a sclerotic area which is impenetrable, the black stain escaping to the surface only at the exit of a foramen.

In our work on the permeability of tooth structure we found that sections of dentin and cementum taken from the middle third of the root could not be penetrated by fluids under osmotic pressure, altho they could be made to pass thru the enamel and dentin quite readily. From this we infer that the cementum on the middle and gingival thirds of the root, exclusive of foramina, is normally impervious to fluids and to bacteria or their toxins and is therefore highly protective to the dental and peridental tissues. It is not quite clear as to whether this impenetrable tissue is an inner and dense layer of the cementum or is a homogeneous layer of dentin matrix just beneath the cementum. The verity of its presence is, however, indubitable.

In the apical third of the root the conditions are quite different. Here the cementodental communication is seemingly quite patent, as shown by the recent work of Harold Box, of Toronto. It is in this region that pulpal infections tend to spread to the surrounding peridental tissues and, as shown by the essayist, the direction of the lymph flow tends to keep them from migrating gingivally. The recent discoveries of Hartzell and Henrici who found streptococci in the pulps of healthy teeth, indicate that bacteria gain entrance to the pulp tissue more frequently than we had supposed, but the avenues by which they enter are, in all probability, confined to the foramina and other spaces in the apical third of the root, except in rare instances.

We heartily agree with the essayist when he says that the pulpless tooth is not necessarily a dead tooth. The mere removal of the pulp from a tooth in no wise disturbs the vitality or function of the cementum or peridental membrane unless they be injured by traumatic, chemical, or bacterial agencies. Moreover the relationship of the tooth to the surrounding tissues has not been changed in any way save the possible deflection of the blood, which formerly entered the pulp to the peridental tissues. A pulpless tooth is therefore not a foreign body for the enamel and dentin alone are dead while the cementum and peri-

dental membrane, those tissues upon which the relationship of the tooth to the surrounding tissues depends, remain alive and maintain their normal function.

We concur with the essayist in the opinion that all serious periapical infections must be treated surgically. However, we do not believe that simple excision of the root apex and curettage are sufficient. The amputated stump of the root presents hundreds of cut dentinal tubuli which are patent and unprotected. In them infectious organisms may invade beyond the reach of the body fluids and their immunizing properties, and later these organisms may be a source of secondary infection of the healing tissues. It is to this fact that many failures of root resection may be attributed. Such operation should always be followed by the treatment of the root stump with silver or some other suitable material which will hermetically seal the dentinal tubuli against bacterial invasion.

We, however, emphatically disagree with the essayist when he says that similar surgical measures are necessary for the treatment of pyorrheal lesions on the lateral surfaces of the root. Nor can we concur with the statement that the peridental membrane cannot be induced to reattach to a "pus-soaked cementum." These lateral and subgingival lesions are quite different from those in the periapical tissues. They have an opening to the exterior at the gingival crevice thru which by proper instrumentation the cemental covering of the root may be freed of exorescences, pits and depressions obliterated, and the surface made smooth and burnished. If in this procedure care be taken not to cut thru the surface of the cementum the root will still be protected by an impervious lamina which will protect the underlying dentin. This smoothened cementum is also perfectly compatible with the surrounding peridental tissues which in a large number of cases under proper treatment may be made to heal from the bottom of the lesion, reattach themselves to the cementum, and obliterate the pocket. It is not easy to present histological slides in proof of this statement for patients for whom this has been done are loath to part with such teeth for microscopic study. But to the large number of pyorrhea workers who are daily treating this disease by rational methods and who see the lesions day by day become less and less deep under their treatment, until at last the tissues are attached about the teeth so firmly that not even the finest nerve broach may be pushed between the hard and soft tissues—to those practitioners there is no doubt of the possibility of reattachment of tissues to cementum which has been diseased. We admit that this method of treatment requires considerable technical skill and that its use is not always attended with success, but the great mass of clinical evidence which has been presented by the pyorrhea workers and the high degree of success which they have attained by sub-gingival surgery leads us firmly to believe that the cure of pyorrheal lesions is possible by the employment of measures which are far less radical than those suggested by the essayist.

We wish to congratulate the essayist on the clear, interesting, and instructive manner in which he has handled this important subject. The paper should serve to clarify the vision of many who are interested in these problems and should lead them to a better understanding of some of the more debatable questions of modern dentistry.

Dr. Skillen (closing): As far as reattachment is concerned, I concur with Dr. Bunting that in some cases this may take place, but I do not believe that a restoration of normal tissue will occur. If the cementum is permeable and there is a connection between it and the dentin, as the evidence seems to indicate, we do not know how far infective substances have permeated these tissues so that scaling down to healthy tissues is a matter of chance. Of course, we know nothing about that possibility as yet. I believe it would be a sorry day that would prove the dentin permeable from the cementum or vice versa, because that would mean wholesale extractions and loss of one of the most valuable organs of the body. I do believe, however, that all treatment should be such as to meet this exigency.

FOOD ACCESSORY FACTORS IN RELATION TO THE TEETH AND BONES

By PERCY R. HOWE, A.B., D.D.S., Boston, Massachusetts

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

THE effects of vitamine deficient diets upon the teeth and gums has been noted by many writers. McCullom, McCullom and Pitz, and others have observed, in guinea-pigs, loosening of the teeth with bleeding or congested gums associated with vitamine deficient diet. Mrs. May Mellanby produced irregular teeth in pups by rachitic feeding. Zilva and Wells histologically examined the teeth of guinea-pigs fed on a scorbutic diet and reported degenerate changes both in the teeth and in their pulps.

The most generally accepted theory of dental caries is that of Miller. Miller held that the fermentation of carbohydrates with the formation of lactic acid was the cause of tooth decay. He based his ideas upon the following experiment: Teeth were placed in the fermenting mixture of bread and saliva, which he removed from time to time so that it might not become alkaline. After three months he obtained effects upon some of the teeth which he states could not be differentiated macroscopically or microscopically from true decay. By zinc crystallization he demonstrated the presence of lactic acid. He felt that he had proved his theory. Histologically Miller studied only the carious mass. He ignored the condition of the tooth substance immediately in advance of the decay. Bacteriologically his work was limited and he found no specific organism which he could regard as the etiological factor in caries.

We repeated and extended his experiment. We placed the teeth in fermenting mixtures of dextrose, maltose, lactose, saccharose, and of dextrin, white flour, and bread. In some of the tubes we used saliva from individuals that had extensive tooth decay, in others saliva from cases of no decay, and in still others saliva from mixed cases. After six months some of the teeth showed an etched appearance, some a decalcified effect, and in others no change was discernible. In general the effects resembled those on teeth that had been subjected to a weak decalcifying agent. The most pronounced thing brought out was the great differences *in structure* of the various teeth. Miller himself noticed this. He wonders that the teeth of pigs which feed largely upon the fermentable foods are free from decay.

If Miller's theory is sound it should be an easy matter to produce tooth decay in animals by fermentation. We have fed guinea-pigs upon diets containing large amounts of the sugars and starches. This diet was continued for from six months to a year. The sugars were readily eaten and adhered constantly to the tooth surface. The flora of the mouth became aciduric in character, but no effect could be detected in any of the teeth. For three to four months we fed them micro-organisms

that were isolated from caries, B. acidophilus, B. (X), B. Ramosus. The growth was constantly present in their mouths. No effect upon the teeth could be found. The animals all appeared to be in good condition at the end of six months and even after a year.

We have, however, obtained rather extensive effects in the teeth, in the alveolar process, and in the jaws themselves by feeding vitamine deficient diets. The effects are not confined to the teeth and their adjacent structures, but are to be seen to a certain extent in the skull bones and in other bones of the body. The majority of our guinea-pigs were fed a simple diet of rolled oats and fat-free milk. They received about 25 c.c. of the milk daily and all the rolled oats that they would eat, with a very small piece of carrot and a small leaf of lettuce every other day or every third day. The animals were carefully watched, and when difficulty in the use of their legs was manifest, or difficulty in eating observed, the amount of green food was increased. This was necessary in order to prevent death, which at this stage ensues rapidly. Our object was to produce a chronic condition in which the lime would be slowly removed from the bony structure. Thus our experiments extended over periods of from three months to a year. When the onset of the symptoms was so rapid that the animals were unable to eat green foods we fed them orange juice from a medicine dropper. They took this with great avidity and its beneficial effects were quickly evident. They were soon able to eat grated carrot, and later thin slices of carrot and lettuce. On the latter diet, combined with whole milk, they soon regained weight and appeared nearly normal. They were then again placed on a diet of rolled oats and fat-free milk, the green food being reduced to the lowest possible quantity. In some cases McCullom's salt mixture, or Mendel and Osborn's, or calcium lactate was added to the diet, altho the milk furnished a sufficient amount of inorganic constituents. Agar-agar was also added in some cases for the effect upon the intestinal tract. By observing the animals, and by the use of such diets, we could keep the animals for a protracted period in any state desired. In this manner we produced a very marked loosening of the teeth, together with an extensive absorption of the alveolar process. If the effect was brought about slowly, and continued for about four months, it resembled the alveolar absorption of senility. If it was brought about with more rapidity and severity the appearance was more like carious bone. The condition closely simulates the various forms of pyorrhea alveolaris. The gums bled, and in some instances a copious flow of pus occurred.

The teeth, particularly in young guinea-pigs, are regularly decalcified. A distinct bending of the teeth is seen; in fact, they can be bent with the fingers and a sharp instrument will penetrate them with ease. In brushing the bones with a soft brush, in the process of cleaning specimens, large portions of the teeth are often removed. The tips of the teeth seem to soften first. Distinct cavity formation appears in some cases. This seems to be true caries.

Many irregular arrangements of the teeth were brought about. In one animal the lower teeth became carious and broke off. The upper incisors also became carious and broke or rubbed off. All the teeth were affected and softened greatly. The lower jaw from the incisors to the molars became decalcified. The animal had to be fed with the medicine dropper. By careful attention he was gradually restored so that he was able to eat properly. The lower teeth grew out and were fixed in a position in which they were exactly crossed. We had effected decalcification and a subsequent calcification. Later the animal was again

placed on the deficient diet, with the formation of large carious areas in his jaws. In this connection it is to be remembered that the guinea-pig is a rodent, and that under certain conditions its teeth will continue to grow.

In a number of other cases the lower teeth became decalcified, elongated, and bent to such a degree that the lower first molars touched each other entirely across the jaw. Irregular arrangements of the molars are very common. The upper molars of one animal were bent outward at about right angles upon one side of his jaw, while upon the other side the palatal surfaces of the molars were gone. Opposite them on the lower jaw the buccal side of the molars were gone.

Other decalcified areas occur in the maxillary bones and in the bones of the head. In some cases such areas are found at the base of the teeth, the carious process extending entirely thru the lower jaw, or at the base of the upper molars within the orbital cavity. Decalcification is often found about the anterior palatal foramen extending posteriorly to the teeth. Carious areas are found along the side of the jaw, and in some cases the entire jaw has been affected. The ribs and the leg bones also marked alteration, altho we have particularly observed effects upon the teeth and jaws.

We have been able to mark the enamel by alternating deficient and normal diets.

The usual joint affectations occur in a marked degree. When this condition has been maintained for a long time, and the animal is then restored to a normal diet, it is found that the legs have become fixed in an abnormal position. This seems to us to be more like rheumatism or arthritis deformans than many experimental conditions that have been called such.

Nervous symptoms are very pronounced at one stage of this feeding. Our efforts to mark the teeth during pregnancy have not been successful, the young being born dead or too prematurely to live. The inhibitory effect upon growth is very noticeable. The tendency to certain infections is evident. Abscesses form about the teeth. Lung and bronchial troubles are present. It is the ability to produce decalcified areas in the bones of the head and in the teeth, and to effect recalcification by diet that is one of the most striking things in these experiments.

Modern diets are often deficient in vitamines: the fat in our city milk is low; our grains are deprived of their germs in the milling process; it is difficult to obtain fresh foods on account of transportation. Yet these are essential for good teeth. Mother's milk at first (and this must contain the proper elements), whole milk, butter, eggs for the fat soluble vitamines, together with the proper vegetables and green leafy foods, whole wheat as distinct from the degerminized floor, principally for the water soluble vitamines, altho this substance is widely distributed in nature, and fruit juices for their antiscorbutic properties, are food accessory factors that cannot be overlooked if we wish sound teeth. Tooth destruction is one of the first signs of lack of vitamines in the diet.

CROWN AND FIXED BRIDGE-WORK. FROM THE POINT OF VIEW OF OUR PRESENT KNOWLEDGE

By R. E. MacBOYLE, D.D.S., Chicago, Illinois

(Read before the Illinois State Dental Society, Peoria, Illinois, May 10-12, 1921.)

THE present status of that branch of our profession relating to crown and bridge-work is evidently one of confusion and uncertainty as judged by the various attitudes toward it of many dentists. Many have become radical in their views against fixed bridges, and when a wave of this kind once starts it is generally carried to the extreme.

This branch of dentistry where rightly used is too valuable as a satisfactory means of supplying missing teeth to allow it to remain in its present rather dejected position, and I believe that it is possible to rescue it and bring it into more popular favor.

There is always a cause for every effect and the cause for the confusion and uncertainty regarding fixed bridge-work lies within a chain of conditions which have not been thoroly understood. Stating the case briefly, conditions concerning this work have radically changed within recent years; or, rather, our knowledge of conditions has radically changed, but dentists generally have not changed their methods as required by added knowledge. Dentists have known that something had occurred which demanded different methods, but many have evidently been unable to determine just what it was, and the majority have continued to employ the old methods not fully realizing the requirements of the new conditions. Many of course did realize that the old methods would not meet their demands successfully, and, not having new and ideal ways to take the place of the old, adopted other means than fixed bridges. This accounts, to a large degree, for the radical wave toward removable appliances, and from this viewpoint it was justifiable.

The first thing to consider in our analysis is, what brought about the change of knowledge of the conditions concerning fixed bridge-work, and the answer is the X-ray. The next in order is, what has the X-ray taught us, or what should it have taught us, and the answer to this question reveals to us the secret of our confusion and uncertainty.

If we have studied the revelations of the X-ray and interpreted them at all correctly, we have learned, first, that we must conserve the pulps of teeth; second, that we must avoid irritation of the gingival soft tissues; third, that we must procure balanced occlusion with and upon our bridges; and fourth, we must use the proper style of dummies in our fixed bridges, keeping in mind one of the most important qualities necessary, which is cleansableness. If this truly outlines the revelations of the X-ray, then, of course, many of the old methods for many cases are practically obsolete. We must have new ways that are more ideal and more universally adaptable in order to meet the new requirements, and especially where we have sound or practically sound vital teeth to deal with.

Before the advent of the X-ray, we

were taught that teeth should be devitalized when used as abutments; that gingival irritation was usually considered as simply a local condition of little importance, and unfortunately it has not been corrected to any great extent. The bad effects of improper occlusion as well as the uncleanliness of improper dummies are conditions which have not as yet impressed themselves seriously upon dentists generally. Devitalization, then, is the only factor which has been corrected to any great extent, and the serious part of this phase of the matter is that, with the cessation of devitalization, we very often find an increase of gingival irritation for the reason that the vital abutment teeth are not prepared as properly for the reception of telescope crowns as were the devitalized ones.

If the foregoing is true, then there is a crying demand for more ideal abutment pieces for vital teeth, and if these can be procured, and if by their use we can avoid the conditions enumerated above, fixed bridge-work will come into its own, the present condemnation of it will cease, and we will, in many cases, supply our patients with missing teeth in the most satisfactory manner. There are other abuses, such as using fixed bridges where spans are too long and where the abutment roots are not sufficiently sound.

A great deal of extracting both necessary and unnecessary is being done and will continue to be done for some time to come. Thus a demand is created in many cases for the most satisfactory means of supplying one, two, three, and ofttimes, in the anteriors, four missing teeth. The question arises, how are we going to best do this, and I personally believe that the most ideal method in the majority of cases is with a properly constructed and adapted fixed bridge. It simply remains for us to devise ideal abutment pieces and dummies in order to meet the modern demand.

Telescope Crowns

As long as we retain broken-down devitalized teeth, there will be a place for the telescope crown. However, it is not suitable for vital posterior teeth for the reason that it causes more or less gingival irritation, due to improperly prepared abutment teeth. We, at least, attempt to teach the proper preparation, but for varied reasons dentists become careless regarding this matter. Just as long as telescope crowns are used upon vital teeth, just so long will they be abused. This is true, no doubt, of all banded crowns, but not to the extent of the telescope.

Preventive Dentistry

We hear a great deal these days about preventive dentistry. All dentistry for children and adults alike should be preventive from the viewpoint of preventing all irritation. Certainly a great majority of our crowns and fixed bridges have not met this requirement in the past, and if we are to continue this work we must keep in mind the preventive idea as a most important phase of the problem.

Dummies

It has been my observation that ofttimes the dummies used, especially in posterior bridges, are of improper form to best meet the requirements of cleansableness and non-irritation, which are certainly two of the qualities which dummies should possess. The dummies for upper posterior bridges should have no shelves or concavities at the lingual or gingival which make cleansing practically impossible. There should be no saddles and, altho the gingival portion of the porcelain should be in contact with the soft tissue, it should not extend too far gingivally, causing it to be in contact with too great a surface. The most universally adaptable dummies at the present time for the upper posteriors are made by using the porcelain pin facing and the metal cusp, for they can be shaped on the lingual with a long sloping surface which the patient can

cleanse. These facings should be narrowed at the gingival portion, leaving an interproximal or washable space between them and also between the dummies and the abutments. The porcelain in contact with the soft tissue should be convex in form and highly polished. In long-bite cases the all-porcelain dummies can be used, such as the Goslee for upper posteriors, because they have the long sloping surface at the lingual and allow porcelain in contact with the tissue instead of metal. In the medium or short bites, the porcelain pin facing is best. Regarding the metal cusps in connection with the porcelain pin facing for upper posterior dummies, the metal is not conspicuous if adapted properly. Regarding the width of the cusps from buccal to lingual, the shorter the bite the less this width should be.

For the lower posterior dummies, the gingival should never be in contact with the soft tissue, but a washable space should be left between the dummy and ridge, and in medium or long-bite cases the Goslee tooth is the ideal dummy. In short bites the all metal dummy is necessary, except possibly on the first lower bicuspid, where a porcelain facing should be used in order to avoid the buccal display of metal. The all-porcelain teeth should be used for lower posterior dummies wherever possible for the reason that it is the occlusal surface which is conspicuous in the lower posterior bridges. For the anterior dummies, porcelain of some variety must be used, but the necessary cleansable qualities should not be lost sight of. Whether the porcelain facings of pin or Steele variety or the Goslee be used depends upon the length of bite and general conditions.

Indications for Fixed Bridge-Work

The indications for fixed bridge-work, as a rule, are in the smaller cases of one, two, or three missing teeth between two abutments, and in the anterior, in the case of the four missing incisors either upper or lower. Ofttimes we may join the smaller bridges by means of solder, making a larger bridge possessing more than two abutments. The abutment roots should be sound, solid, and not affected by pyorrhea. In posterior cases more than three dummies should never be supplied between two abutments, and if the third molar is the distal abutment three dummies are too many for a fixed bridge unless conditions are very favorable. Full upper or full lower one-piece fixed bridges are generally contra-indicated; in these conditions a removable structure is as a rule indicated. If all of the molars are missing on one side, a fixed bridge should not ordinarily be made for the opposite side, but rather a removable structure made to supply both sides. The same rule would apply to the larger anterior spaces if the posteriors were missing on either or both sides.

An ideal abutment piece must possess the following qualities: (1) minimum of tooth mutilation; (2) adaptability to vital teeth; (3) non-irritation to gingival soft tissues; (4) require no anesthetic for preparation; (5) cleansableness; (6) avoidance of splitting of the tooth; (7) capable of successful construction by the average dentist; (8) good aesthetic appearance; (9) successful cementation.

We will first discuss the posterior abutment piece which is a combination of an occlusal inlay and a full or partial band, and is made by the indirect casting method. Figure 1 shows the prepared lower molar; the abutment piece has been removed in rough casting, and the finished piece is in place. In the preparation, the occlusal fissures are cut out and extended thru to the mesial, buccal, and lingual surfaces. The occlusal inlay portion attaches to the band portion, and the part of the tooth to which the band portion is adapted must be straightened. At the soldering surface, the band must extend gingivally to the normal gum line. The cusps are not

ground and there is no shoulder or cut in the finishing line at the gingival edge of the band. To get an idea of the adaptation to the tooth, it is necessary to visualize a perfect fitting inlay for the occlusal portion, and the band portion, and the straightened surface of the tooth should approximate each other as two perfect planes of glass. The gingival edge must be beveled and in perfect adaptation to the tooth, so that an explorer may be drawn over it without catching. With this adaptation, there is no chance for the cement to wash out.

Let us refer again to the shell crown and the reason for its faulty adaptation to vital teeth. It is because it is most difficult to straighten the tooth at the gingival area at the buccal and lingual surfaces. In this new abutment piece this area is avoided, making the straightening process very simple and requiring slight tooth mutilation. The cusps may be covered but this is necessary only in case of building up or restoring the occlusion. In Figure 1 the distal of the tooth is not touched, but the preparation may be modified to meet a great variety of conditions. Any cavity opening on the occlusal surface is included in the structure, and the band portion may cover either the buccal or the lingual surface of a molar, ofttimes in this way avoiding the most bell-shaped surface.

Fig. 1

Figure 2 shows the upper molars; first the preparation of the tooth, and the abutment piece both removed and in place; the same description for Figure 1 applies to Figure 2. On the upper first molar, however, it is not necessary to straighten or make the mesial surface perpendicular. The bell shape must be straightened but the mesial flare is allowed to remain because, by beveling the occlusal fissure which extends from buccal to lingual on the side toward the mesial, it parallels the occlusal portion

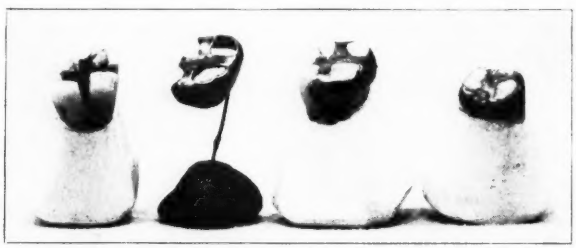

Fig. 2

with the flare of the mesial portion and the abutment piece will go to place with a perfect adaptation at the gingival. The upper first molar which is so difficult to prepare for a telescope crown is easily prepared for this new abutment piece and this idea of allowing the flare to remain may be also carried out in other teeth.

Fig. 3

Figure 3 shows two bicuspid abutment pieces; in one the occlusal fissure opens from mesial to distal surfaces and there connecting with the band portion which covers the mesial and distal and lingual surfaces, but does not extend to the gum line at the lingual. The lingual cusp may be covered but the tooth is not grooved on the mesial and distal surfaces. In the second there is a special piece for a bicuspid where the band portion is adapted to one side, which is the soldering surface, extending slightly around on the buccal and lingual to support the tooth against splitting. In this piece the fissure is not carried thru to the opposite side, but in the extreme end of the fissure a small No. 20 gauge pin, one millimeter in length, is placed into a counter-sunk pit in the dentin well removed from the pulp area, for anchorage.

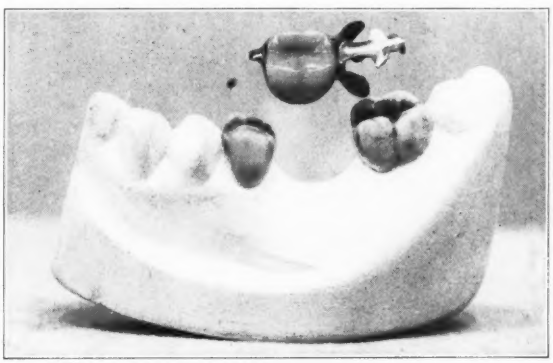

Fig. 4

Figures 4 and 5 show a method of supplying a missing lower first molar. The same idea applies to the upper first molar with the proper upper dummy. This illustration shows a special molar

abutment piece similar to the bicuspid just described, but the full molar abutment piece may be used connecting the inlay portion with the buccal and lingual as well as the mesial. The second molar will hold the first molar dummy provided the mesial end is supported against gingival stress.

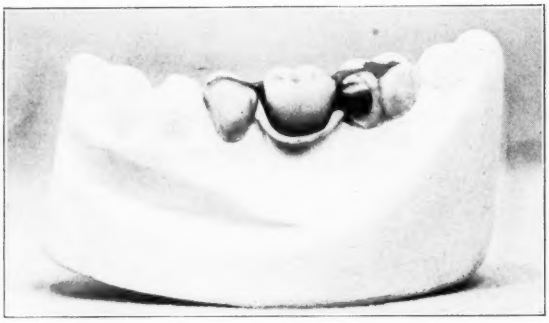

Fig. 5

Figures 6 and 7 show a case of too large a span for a fixed bridge where the abutment pieces are cemented to the abutment teeth and the dummies made removable, using the Roach or any suitable attachment, and adjusting the structure so that the ridge and the abutment pieces will share the stress. This demonstrates a combination of fixed bridge-work, removable bridge-work, and movable-removable bridge-work, and should provide a means of bringing together the radical advocates of each variety. This idea is indicated in two conditions; first in spans too large for fixed bridges, and, second, where the abutment teeth tip toward each other to the extent than an entire fixed bridge would not go to

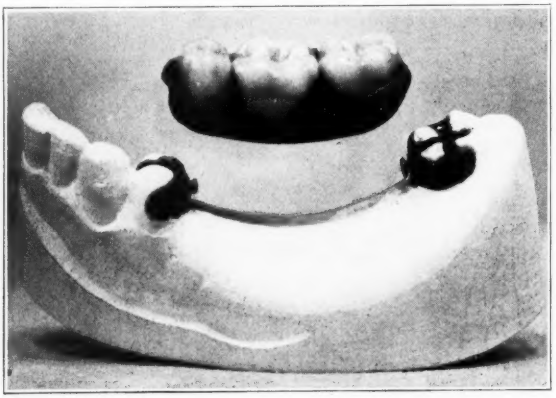

Fig. 6

place. The removable-bridge advocates may use the idea to advantage in many cases, fixing the abutment pieces by cementation and making the dummies removable; in these cases, if the patient fails to remove and cleanse the removable portion for a matter of days the abutment teeth are not being harmed. This idea may be carried still farther to meet the desires of the fixed-bridge advocate; it is possible to construct a fixed bridge even where the abutment teeth are out of reasonable parallel by following Figures 6 and 7; in smaller spans, the saddle may be omitted and a heavier and suitable attachment used in place of the Roach attachment, to be fixed by cementation. In the case of a two-abutment bridge where but one of the abutment teeth is out of reasonable parallel it would be only necessary to use the extra attachment at the one end.

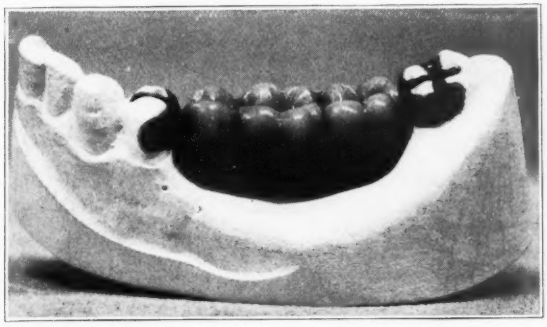

Fig. 7

Technic of Construction

This posterior abutment piece is cast in one piece by the indirect method. The tooth is prepared, and an impression taken of it with inlay wax which is confined in a suitable thimble matrix and festooned to avoid the sides of the tooth which have not been straightened. A model of the tooth should be made by filling the impression with Brophy's Universal Investment material or Weinstein's Clasp Investment. After it has been allowed to crystallize for fifteen minutes, it should be placed in warm water and separated. While the model is moist, the occlusal fissure should be filled in and built on the band portion with fused inlay wax, to be carved as desired, and the surfaces smoothed perfectly. The sprue wire should be attached, as indicated in Figure 8, and the waxed model saturated with water and invested in the same way as an inlay, the same material to be used as was used in making the model. After twenty minutes, the wax should be boiled out and heated carefully, avoiding overheating of the investment, and cast, using the cast clasp metal for the special pieces with free band ends, and inlay metal for the pieces with more attachments to the inlay portion. These may all be cast with clasp metal, but inlay gold is sufficiently rigid for the full pieces, and it will permit burnishing of the margins if necessary. The free ends of the band in the special pieces should be built in heavier than a band portion of the full pieces. If the technic is followed carefully, no grinding will be necessary on the inner surface. Exacting and careful technic is necessary to assure success.

The claims made by the movable-

removable bridge advocates for the necessity of individual tooth movement are considerably exaggerated. I base my opinion upon the evidence of many properly constructed fixed bridges which have come under my observation, and which have given good service for years without evidence of irritation or injury to the abutment teeth and surrounding tissues. Gingival irritation and unbalanced occlusion are the causes in most cases of the troubles attributed to the immovability of the abutment teeth. The peridental membrane acts as a cushion, and a properly balanced fixed bridge does not prevent, to any injurious degree, the individual movement of the abutment teeth, especially in the fixed bridges of reasonable size.

To make a successful completion of this problem, we need an ideal fixed abutment piece for the six anterior teeth in both jaws. Figure 9 shows four views of this abutment piece for vital teeth to take the place of the older methods. It is a metal construction covering the lingual, mesial, and distal surfaces of the tooth, perfectly adapted and extending to the gum line at the mesial and distal, avoiding the gum line at the lingual. This should be anchored by means of two pins located near the incisal area well toward the mesial and distal and extending into small canals drilled

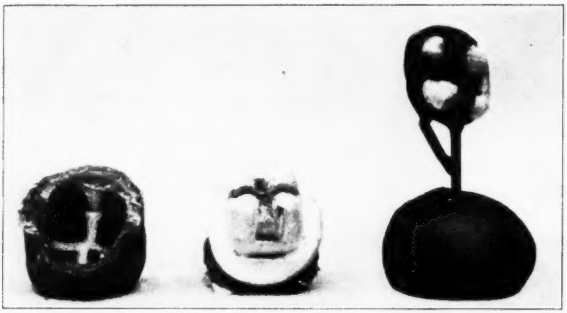

Fig. 8

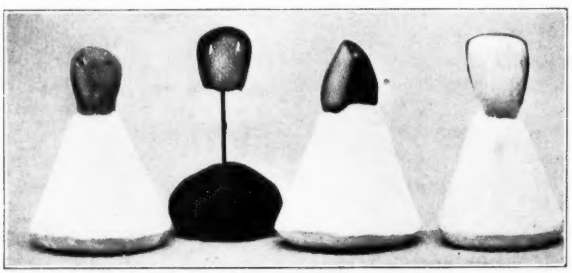

Fig. 9

into the tooth well removed from the pulp area. These canals are slightly less than one-sixteenth of an inch in depth in the larger teeth, and gauge No. 20 in size. In the lower incisors, two pins one millimeter in length and gauge No. 22 are used. If the pins are placed at the incisal area this abutment piece is made adaptable to the lower incisors as well as to the larger anterior teeth. This is the logical place for the pins because in both uppers and lowers the pins should be at the place of most stress. It is possible to place a third pin in the area of the cingulum of the tooth, if necessary.

The tooth is but slightly mutilated, there are no grooves cut, and no shoulder at the gingival. The incisal edge is beveled about 45°, and the metal extends just slightly to the labial of the contact point on the mesial and distal surfaces. The labial contour of the tooth is not impaired but in the preparation any bell shape is removed from the surface covered, so that the adaptation is perfect at all margins. This anterior abutment piece is made preferably by the swagging and burnishing method. An impression is taken of the prepared tooth in modeling compound, then a cement model is made from this impression over which pure gold No. 34 gauge is swagged and over this a second piece is swagged for reinforcement, 22 carat No. 34 gauge. This second piece is put aside until the first piece has been fitted to the tooth in the mouth and the pins soldered to it. After the pins are soldered to the first pure gold backing it should be placed on the tooth in the mouth and trimmed and burnished perfectly. It should be removed carefully, filled with crown and bridge investment, and the second piece adapted for reinforcement. In the second backing, large holes should be cut to fit over the projecting pins, and a slit in the center of the second backing; in soldering the two plates together, the pieces of solder should be placed in the slit and around the pins. Further reinforcement can be done if desired by sweating solder upon any portion of the structure.

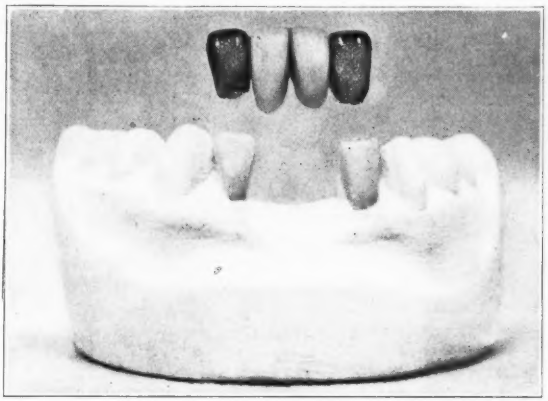

Fig. 10

Figure 10 shows a bridge supplying the two missing central incisors by using these anterior abutment pieces upon the laterals (Fig. 10 shows the bridge removed and Fig. 11 shows it in place).

The anterior abutment piece may be

made by the casting method if desired, in the same way as described for the posterior pieces. The pins should be threaded or roughened and in place in the tooth when the wax impression is taken so that they will be in the proper relation in the model. The fused inlay wax is then placed around the projecting ends of the pins and upon the model to the desired form and contour, the sprue attached, and the case invested, and cast.

Small pins which will often still further avoid mutilation of tooth structure may also be used to advantage in connection with the posterior abutment piece as a means of anchorage; however, they must be in place in the tooth when the wax impression is taken.

I referred to the possibility of many modifications of the posterior abutment piece. They are almost endless in variety, combining the inlay and band portions on different parts and surfaces of the tooth in order to meet different conditions. But there is one which I find most useful in the case of abraded or worn down cusps where it would be necessary to cut fissures into sound and sensitive tooth structure. Three small, step inlay cavities should be prepared, one at the mesio-occlusal, one at the bucco-occlusal, and one at the linguo-occlusal, dovetailing the occlusal portions and the band portion extended on the buccal, mesial, and lingual surfaces.

In case there is a cavity on the distal surface, it is included in the structure, the other inlays being placed at the mesial or soldering surface and at either the buccal or lingual surface, but not both. This idea may of course be used in the case of any molar or bicuspid, where the occlusal surface is sound and where there are no fissures to be cut out; but it is especially indicated in the cases of abraded occlusal surfaces.

The combined inlay and band idea may be used to advantage in the case of fillings, where the tooth is broken down by decay, but still vital. Instead of the sensitive structure being cut into for retention, the band portion should be used as conditions indicate, for retention as well as a support to the tooth.

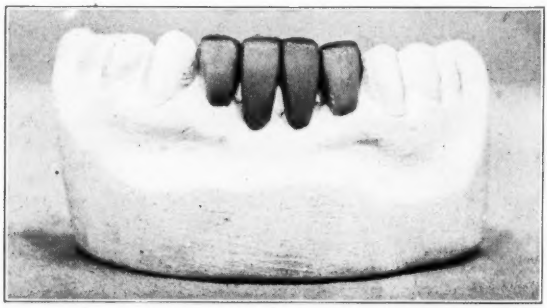

Fig. 11

Discussion

E. R. Hart, St. Louis, Missouri: Altho we may not entirely agree with the essayist on the technic which he offers as a remedy for existing conditions, yet we must admire any man who offers a means of improving the horrible condition which obtains in the practice of crown and fixed bridge-work.

Our profession seems to be divided into two camps, one group using only the fixed type of bridge-work, the other claiming that a removable or movable-removable is the only type of bridge that fulfills the anatomical, physiological, and aesthetic requirements. I agree with our essayist that there is a place

in the practice of modern dentistry for each type and we should not become so enthusiastic over any one type of restoration that we lose sight of the fundamental principles that are necessary to the avoidance of those histopathological conditions which may arise with all forms of crown and bridge-work when improperly constructed.

It is surprising how little understood, and much less appreciated, are the influences exerted by improper construction and lack of judicious differentiation in the selection of the type of restoration for a given case. I have no desire to enter into a controversy as to the relative merits of fixed bridge-work as compared with removable. I very willingly admit that both types, when judiciously employed and properly executed, have their proper places in the practice of modern dentistry. We have the same stresses to contend with in the removable, as well as in the fixed type. There are the same possibilities of torsion if constructed upon wrong mechanical principles. After all, the sole difference between fixed and a removable bridge is that in the fixed the union of the superstructure with the artificial supports, crowns of the various types or inlays, is a physical union, while in a removable, the union is mechanical, provided by means of a mechanical attachment.

As to attachments, no doubt the ones shown by our essayist are in his hands successful, for it is always well to remember that the personal equation enters very largely into the practice of dentistry. I cannot see wherein the attachments shown for molars and bicuspids are preferable to an inlay cast for a second-class modified second or compound second-class cavity. I would prefer an inlay for one form of second-class preparation, for the reason that it can be finished to a definite cavo-surface bevel around the entire periphery. I should hesitate to place the ear or clasp-like extension bucco-lingually, for it is a lap joint, which is absolutely contra-indicated in inlay work or fillings of any other kind. Also, by using the molar and bicuspid attachments as shown the outline form of the tooth is decidedly changed, and in the mouths of singers and public speakers this would be a great annoyance, to say nothing of interfering with the occlusal balance in many cases. The attachments shown for bicuspids would narrow the space to be used for the dummies, materially interfering with their mesio-distal diameter. Instead of the cope attachment, I would much prefer the Tinker three-quarter crown, for it involves as few surfaces of the tooth, and in those teeth, centrals, laterals, and cuspids, where the enamel of the incisal edge has not been destroyed by caries or worn by attrition, it is not at all necessary to involve it, consequently showing no gold. This form of attachment can be finished with the same nicety as a gold foil filling or a gold inlay, that is to a definite cavo-surface bevel about its periphery, so there will be no irritation whatever; when cast it will be an accurate metallic complement to the macroscopic anatomy of the prepared tooth.

In fixed bridge-work, it seems advisable not to use any form of dummy which presents gold to contact with the epithelial tissues. It were better to use highly fused porcelain, which is acceptable to the epithelial tissues and most hygienic; the possibility of histopathological conditions arising is immeasurably lessened.

I would like to stress several points in regard to dummies: (1). In form they should be similar to the teeth which they replace. (2). They should be a complement to the edentulous space or spaces which they fill. (3). They should differ from the natural teeth only in that they taper abruptly from the gingival third, offering a small point of contact to the crest of the ridge. By giving to the dummies this taper, the food is forced rather violently against the epithelial surfaces, which is desired, as it is stimulating and constructive, for it increases the blood to these parts and lessens the possibilites of retrogressive tissue changes. (4). By accurately reproducing the axial surfaces, mesial, distal, buccal, and lingual, we very advantageously enhance the role they play in mastication, enunciation, and articulation. (5). They must preserve the normal form of the interproximal spaces, and their contact with each other, as well as with the abutment pieces, should be identical with the contact points of the natural teeth. Never should there be a closed joint from buccal to lingual or from incisal to gingival.

Hart J. Goslee, Chicago, Illinois: If you will look back several years, I think you will agree with me that only a few years ago some of us teachers and specialists in this particular line of work thought we had the subject pretty well in hand, and that there was more or less of a standardization of methods and that the field was covered in a manner which assured successful results to a greater or less extent.

Then came the propaganda against pulpless teeth, and the ruthless sacrificing of so many of them. And then came the propaganda against fixed bridge-work and the assertion that it had no place in dentistry, and that everything must be of a removable character.

I believe the most valuable contribution that

has been made to the subject of crown and bridge-work during the past several years has been made by Dr. MacBoyle, and I am convinced that we will learn this to our great satisfaction as soon as we put his suggestions into practical application.

The particular requirements in connection with the replacement of missing teeth, as I see them and in view of our present knowledge, are these: *first,* a *minimum of tooth mutilation,* as emphasized by Dr. MacBoyle, and, *second,* the avoidance of gingival irritation. For many years there has been a concerted fight against banding the necks of teeth or placing crowns with bands upon the roots of teeth. There has been a continued and vigorous fight against the use of bands because of the fact that they almost invariably produce gingival irritation to a greater or less degree. While this always was and is still true as applied to single crown work, it is also true of any form of attachment heretofore used as a means of supplying missing teeth, either by fixed or removable bridge-work.

Dr. MacBoyle now gives us some very valuable suggestions along the line of *tooth conservation,* and the *elimination of gingival irritation,* the two vital things that we want and most need.

It has been said that there is no place in dentistry for the gold shell crown, and the statement has been made as vigorously as was the statement that there was no place in dentistry for fixed bridge-work. I think there is a place in dentistry for the gold telescope crown, and that place was pointed out to you by the essayist. In badly broken down pulpless teeth I believe that we can often best make many of them useful for several years to come by means of the gold telescope crown and I am equally confident that there will always be a place for fixed bridge-work.

I welcome the thoughts and suggestions given us because they are applicable to either removable or fixed bridge-work and to sound vital teeth.

One reason I have never felt keenly in favor of an inlay as an attachment or abutment piece for bridge-work of any type has been because of the necessity for extreme tooth mutilation. For that same reason I have never been in favor of the three-quarter crown. The properly adapted and well constructed three-quarter crown has a place of usefulness, but it is not universal in application, and the difficulty of obtaining an adaptation as accurate as the more simple suggestions offered to us by the essayist makes it less generally useful. Therefore I want to emphasize again that Dr. MacBoyle has given us an ideal method of attachment for vital and for good sound teeth, for the replacement of missing teeth by any form of bridge-work, whether it be removable or fixed, and it is my belief that his suggestions will live long and be practiced successfully by all of us.

Dr. MacBoyle (closing): The methods I have attempted to outline to you in a brief way have given me more satisfaction in my practice than anything else. Dr. Hart spoke of increasing the occlusal surface. That is an element of no importance if it is constructed properly. He spoke of increasing the diameter of the tooth, and that element is so slight that it is of no consequence.

One point which Dr. Goslee referred to is something which I have been trying to work out, namely, the slightest mutilation of tooth structure. I cannot do it with the method referred to by Dr. Hart.

Another point I have tried to bring out is to develop something, which the average man can construct. I want to emphasize the point that if an attempt is made to cut a shoulder at the gingival border, or a finishing line, the thing which Dr. Hart referred to, and that construction placed in the hands of one hundred different dentists, there will be a very small percentage that will be adapted properly to that shoulder or finishing line. I gave up the cutting of shoulders in my practice many years ago and I have since been relieved of a great deal of trouble. What is the use of having some method or theory we cannot put into practice? The principal thing is the avoidance of the mutilation of the tooth.

Dr. Hart and I agree quite fully on the matter of dummies. The dummy he described is practically the same as I described and believe in, altho in his description of the contact point I think he would find it would have a broader contact of solder if his bridge would stand up. In his cuts he showed that the contact soldered surface was larger than the natural contact of the tooth.

THE DIAGNOSIS OF PERIODONTAL DISEASE

By RUSSELL W. BUNTING, D.D.Sc., Ann Arbor, Michigan

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

OF ALL the diseases which lie within the realm of dental practice those which affect the tissues immediately surrounding the teeth are most imperfectly understood and are given the least attention. It is not that these diseases are unimportant, for by their ravages they accomplish as much if not more damage to the dental apparatus as do those which primarily affect the teeth. Nor does this apparent neglect arise from the fact that these diseases are uncontrollable or incurable, for of all oral affections there are none which may be so definitely and successfully prevented as are those which affect the periodontal tissues. Truly this is an anomalous situation in that as a profession we should overlook or treat lightly a disease which is of so great significance and which, if we would, we might almost completely eradicate.

This attitude toward periodontal disease arises chiefly from the fact that these tissue disturbances are not recognized or their significance is minimized until they have passed thru the primary stages, in which they may be controlled, and have arrived at the more advanced stages, in which considerable tissue destruction has been accomplished and successful treatment is exceedingly difficult or impossible. As a result of their failure to obtain results in the treatment of these advanced cases, many practitioners have become disheartened and have lost faith in their ability to control periodontal disease.

The hope of controlling periodontal disease does not lie in the treatment of advanced cases but in the early recognition and correction of incipient forms of the disease which readily respond to preventive measures. These earlier stages consist of disturbances of circulation and nutrition in the periodontal tissues, which disturbances lead up to tissue destruction or metaplasia. If at this time the disturbing factors be removed and the normal circulation be reestablished the tissues will again receive their proper nourishment and their subsequent destruction will be avoided.

The prevention of periodontal disease is therefore very largely dependent on the early recognition of the departure of the tissues about the teeth from their normal physiological function and the diagnosis of the type of disturbance which has taken place in them. It is then to a discussion of the means of diagnosis of the various types of periodontal disease as related to the methods of their prevention that your attention is called at this time.

It should be recognized at the outset that the course of these diseases, like that of all other bodily affections, is the resultant of two factors, one the attacking force and the other the resistance of the tissues attacked. The first of these consists of various local irritants:

(1) traumatic, as traumatic occlusion, food impactions, calculi, improperly adapted fillings, crowns, bridges, etc.; (2) chemical, as circulatory depositions of mercury, salts of uric acid, and other irritating substances; (3) bacterial, as streptococci, staphylococci, fusiform bacilli, etc. The effect that this first group of irritating substances may produce on the periodontal tissues is determined by the strength of their attack and by the type of resistance with which the local tissues combat them. This second factor, that of tissue resistance, is also a variable quantity. It is dependent on the type of circulation, density, and physiological function of the local tissues, which properties are in turn largely determined by the quality of general health and constitutional status of the individual. In the evaluation of each case of periodontal disease one must consider not only the local forms of irritation but also the general health of the individual as expressed in terms of local tissue resistance. Periodontal disease is a local disease inasmuch as its initial manifestations are confined to the tissues which surround the teeth, but the course of the disease, whether it be mild or severe, superficial or deep-seated, will be largely determined by the general health and resistive powers of the individual.

In view of the wide range of local and constitutional factors which may enter into the various cases of periodontal disease it will be recognized that these are extraordinarily complicated and involved processes. As each may be the product of a number of local and systemic factors, it follows that almost an infinite number of combinations may be formed by the harmful agencies which militate against the health and integrity of the periodontal tissues. Consequently this disease is not uniform or constant in its manifestations but presents many phases and variations during its course. Success in treating and controlling these conditions is dependent on the recognition of the most predominating factors in each case and the institution of measures which will either remove the determining causes or reduce them to a state of inefficiency. To accomplish this a close study must be made of the various cases which are presented and methods of diagnosis must be established by which the various types of periodontal disease may be recognized to the end that intelligent treatment may be instituted to control them.

Our means of diagnosis of periodontal diseases are limited to certain subjective signs or symptoms which may be noted in the tissues affected. Sometimes these symptomatic changes are in striking and vivid contrast to the normal tissues, so much so that they compel the notice of even the casual observer. Not infrequently, however, pronounced pathological changes are produced in the tissues with but slight outward evidence of their presence. These latter often escape observation until they have seriously and irreparably injured the underlying tissues. It is very essential, therefore, that a definite routine method of examination be adopted in all cases by the application of which the health of the periodontal tissues may be rightly judged and the insidious as well as the conspicuous forms of disease discovered. For this purpose the following classification of tissue changes has been adopted: changes in color, changes in form, changes in density, changes in attachment to the necks of the teeth. These are supplemented by secondary or more advanced local symptoms as: loosening of the teeth, presence of pus, radiographic evidence, and a consideration of the general systemic health.

Changes in color—The normal color of the gum tissues varies in different individuals ranging from light to dark shades of pink, but in all cases *the color is uniform thruout.* This color is the

reflection of the hemoglobin in the capillaries, which lie immediately beneath the mucous membranes, while the depth of the color is determined by the quantity and quality of blood in the vessels. In full-blooded individuals the submucous circulation is filled with red blood which gives a deep pink or dark red color to the gum tissues. In contrast to these the anemic and undernourished types have less blood in their peripheral circulation, the hemoglobin content is usually low, and the color of the gums is normally, for them, a light shade of pink. Thus we may read in the general gum colors many interesting and important facts concerning the general health and the character of the general circulation.

Any localized deviation from that uniform color characteristic to the individual is indicative of local changes in the circulation. Darker shades of red usually denote hyperemia, the depth of color depending on the severity of the circulatory disturbance. Deep red and blue are indicative of stasis and passive congestion resulting in an engorgement of the submucous tissues with venous blood. These localized changes in gum color should be a signal to the operator of danger, for, as a result of circulatory derangement, these tissues will suffer from a lack of nourishment and will lose their normal tone and resistive powers. It may also be noted in the vicinity of these color changes some form of irritant, either chemical, bacterial, or mechanical, may be found which is producing an active injury; upon removal the color of the tissues, as a rule, promptly returns to normal. By experience one may also read in these gum colors the types of protective reaction which are being put forth by the tissues to combat the injury. When the tissues are red and give evidence of strong inflammatory reaction the disease is largely superficial and the deeper tissues are involved only after a considerable lapse of time. Cases of this type respond readily to treatment and the tissues have a marked recuperative power. Conversely, when the gum colors are pale or dark blue the tissue disturbances are more deep-seated and their response to treatment is less favorable. Color changes therefore constitute a very important diagnostic factor in the discovery of periodontal disease and in the evaluation of local tissue reactions.

Changes in form.—Normally the gum contour about the teeth follows that of the edge of the enamel at the neck of the tooth, which it slightly overlaps. In the interproximate it extends up to the point of contact completely filling the space between the adjacent teeth. Deviations from the normal contours are of two types, namely shrinkage or retraction of the gum line and swelling or hypertrophy of the gum tissues. Examples of the former may be seen in the retraction of the buccal or lingual contours resulting from toothbrush abrasions or the atrophy of old age. So also are the gingival tissues retracted following deep involvement by periodontal disease. Swelling of the gum tissues about the teeth is indicative of a strong inflammatory reaction induced by some form of irritation and usually signifies a high degree of tissue resistance and recuperative power. When the tissues show a tendency to shrink and contract under injury it may be inferred that their resistance is low and that degenerative changes may easily be induced in them.

Changes in density.—The normal gum tissues are hard, firm, and resistant to mechanical injuries. When in health the mucous membrane is tightly stretched over an underlying dense connective tissue which is supported by the alveolar process. This epithelium should be so tough that even under vigorous mastication or brushing of the teeth abrasion or hemorrhage will not occur. Soft and spongy gums, however, are easily torn and abraded and hemorrhage may be produced in the course of ordinary mastication or by slight injuries. When

in this condition the gum tissues are never in health but rather are they subject to infection and may be severely injured by insignificant causes. Spongy gums are indicative of chronic passive congestion of the local tissues, which may arise from continued local irritation, from lack of gum massage, or from systemic or constitutional causes.

The line of attachment.—Normally the gum tissues are firmly attached about each tooth to the peridental membrane at the bottom of a shallow gingival crevice. When by exploration it is determined that this normal attachment has been disturbed and that a space exists between the root and surrounding tissues, it is evident that the underlying structures have been severely injured. Intensive inflammation and pronounced swelling may be present in the superficial and gingival tissues, but as long as the line of attachment about the root remains normal, serious disturbance of the underlying tissues has not occurred. Therefore by careful exploration of all gingival crevices one may determine by their depth whether the case under observation is superficial or deep-seated in type. This is indeed the most important and most certain method of diagnosing periodontal disease.

Loosening of the teeth.—It is only in the more advanced and severe cases that the teeth become loosened in their sockets. Since the lesions, as a rule, are confined to but one or two sides of the teeth and tend to extend apically along the lateral surfaces of the roots rather than about them, deep lesions may be produced about teeth which still possess sufficient peridental attachment to hold them securely in position. When by reason of the extension of the disease one or more of the teeth become loose it may be inferred that the condition is very serious and the possibility of successful treatment is doubtful. When there is only a moderate degree of movement and when by radiographic evidence it is determined that at least the apical half of the root is imbedded in bone, if other conditions permit, treatment may be attempted. But when on percussion the tooth plays up and down or may be rotated in its socket, and the radiographic findings show that the surrounding bone has been destroyed, treatment is usually contra-indicated.

Pus.—The presence of pus has been used by many as an important and specific means of diagnosing periodontal disease. But pus is by no means a specific feature of this disease inasmuch as a large majority of its lesions have no visible purulent discharge. The only information that may be derived from the discovery of pus is that the predominating organisms are purulent in type and that against them the tissue reactions are of good order. Instead of being a symptom of grave significance, pus is an indication that the tissues are combatting the infection and perhaps controlling it and that in view of the active local reaction the prognosis of treatment of such cases is favorable.

Radiographic findings.—There are many radiographers who claim that they are able to diagnose all stages of periodontal disease by the radiograph, but in our experience this form of diagnosis is accurate and valuable for only one phase of the process, namely, the extent of bone destruction. In all other questions regarding the extent of involvement one may easily be misled by radiographic evidence; for instance, it is difficult and often impossible by these means alone to differentiate between an active and a healed lesion of the disease. An opinion, therefore, should never be formulated from the evidence of a radiographic film alone, but rather should all other means of diagnosis be employed in which the radiograph is but one factor. From the radiograph a more or less accurate conception of the amount of bone destruction may be obtained. In this also there is a possible source of

error in that the destruction of the interproximate bone may take place to produce a hole or cusp-shaped depression between two adjacent teeth, while the labial and lingual plates are still intact, in which case the exact status of the osseous lesion is not easily determined by the radiograph. So also the destruction of bone on either labial or lingual aspects of the tooth may not be apparent when the opposite bony walls are unaffected, as the shadow of the healthy portion obscures the outlines of that which is diseased. Too much dependence, therefore, should not be placed on the radiograph in the diagnosis of periodontal disease but rather should it be employed only as an auxiliary and a subordinate factor in the whole chain of evidence.

General considerations.—By means of the foregoing methods of diagnosis fairly definite information may be obtained regarding the local conditions, but whenever it is determined in this manner that the periodontal tissues are diseased the examination should be extended to include the general state of health of the individual. In severe cases secondary effects may often be noted in the general health, while in the incipient forms of the disease underlying causative factors may frequently be recognized which constitute active or predisposing factors in the case. For example, periodontal disturbances commonly occur in conjunction with malnutrition, intestinal stasis, uric acid diathesis, and many other general disorders, so much so that an interrelationship between the local and general disturbances is often very apparent. Too much stress cannot be laid on the importance of considering the patient as a whole. When certain types of cases are treated solely from a local standpoint the benefits of such treatment are but transitory and the disturbances tend to recur. If, however, the underlying systemic factors are recognized and corrected the local conditions may be successfully controlled. The diagnosis of all advanced or persistent cases of periodontal disease should include a complete physical examination of the patient, which procedure should also be followed in the incipient and milder forms of the disease whenever possible.

The foregoing methods of diagnosis are presented, not as an original of infallible means or recognizing periodontal disease but rather are they intended as a simple workable scheme which, if adopted as a routine part of everyday practice, will enable the operator to discover many of the incipient forms of this disease which heretofore he may have unwittingly overlooked. When the habit of observation has been developed to the point that he may read these gum conditions at sight and when he recognizes how prevalent these incipient periodontal disturbances are then will the operator be impelled to institute prophylactic measures for such cases which will check these diseases in their inception and prevent their more serious sequelae. Thus may we most effectively control periodontal disease.

Discussion

J. O. McCall, Buffalo, New York: Dr. Bunting states that the radiograph is of comparatively slight value in the diagnosis of periodontal lesions. With that I wish to disagree. It is true that only the amount of bone around the tooth is shown by the radiograph, but there is a difference in the character of bone lost as well as in the extent, which is indicative, if properly interpreted, of many different conditions, particularly where there is a borderline condition between the pulp involvement and the periodontal involvement. Those things can be frequently shown in the radiograph when you cannot determine them definitely in the mouth itself. Furthermore, I disagree with Dr. Bunting's interpretation of the calculus appearing under the gum margin. It is my experience that serumal calculus, as we have always called it, or since the days of Black, at least, is always an indicator of a previous disturbance. That previous disturbance may lie in an unclean mouth, but it

also frequently lies in a traumatic occlusion, which cannot be determined in any other way. It may not show itself in the radiograph, it may not show itself in any pocket formation, but it is capable of being definitely determined and established as a cause before the serumal calculus is removed. I am not saying that on my own evidence alone, but on that of a number of others who are working along the same line, particularly Dr. Stillman, who has brought this subject of traumatic occlusion into prominence. We prefer to correct our traumatic occlusion before we proceed to the final cleaning up of the case. It is a very commonly occurring phenomenon that the congestion of those gum tissues will be very materially reduced merely by removing the traumatic occlusion. After establishing that condition as being present, and having indicated its removal by the improvement in the gum tissue, then go ahead and clean up the irritating calculus itself, which must of course be finally removed for a complete re-establishment of health. Dr. Bunting mentioned the importance of getting at the fundamental condition of the case first, and that is frequently the fundamental condition in these cases. Look for your traumatic occlusion first; if it is there correct it; then go after the calculus, which may be secondary to the occlusion itself.

Hugh G. Tanzey, Kansas City, Missouri: I wish to question Dr. Bunting's diagnosis or conclusions as to the etiology of the conditions existing where he showed the straight teeth on the labial surface. If you will observe those conditions in the teeth, I think you will invariably find, or at least in the greater percentage of those cases, that the lower incisors or the upper canines are affected. Those teeth are labial to normal or to the alignment as nature intended. Of course, the upper canines naturally occupy a corner position, and excessive or violent use of the toothbrush will cause recession of the gums, which later results in the loss of the supporting structures. With the lower incisors the same condition exists. A narrow arch above probably crowds the lower teeth into malpositions; the incisors occupy a position labial to the proper alginment, and any excessive use of the brush, or even the continued stress upon the gums from this malposition, will cause the weakening of the teeth because of the insufficient supply of blood to that part of the tissue lying immediately in front of the teeth.

Dr. Bunting further suggested that the radiograph was not sufficient evidence. I agree with him to the extent it supplies only circumstantial evidence in the way of making the diagnosis. It does show the loss of supporting structure, which is very good; it does not show any infection.

ACID PRODUCTION BY STREPTOCOCCUS VIRIDANS IN MEDIUMS OF DIFFERENT HYDROGEN-ION CONCENTRATION

By LINWOOD G. GRACE, D.D.S., and FLORENCE HIGHBERGER

From the Research Institute of the National Dental Association

THAT the reaction of culture mediums is important is a mere reiteration of a statement found in every textbook on bacteriology. As to just how important it is we are only beginning to realize. Various reports have been made as to the optimum reaction for different organisms. It is quite probable, however, that much work will have to be done before it can be stated just what this is, for each known organism or group of organisms, with any degree of certainty.

In the literature we find numerous references to the initial reaction of given mediums used for the cultivation of the streptococcus. A bulletin from the Army Medical School suggests PH 7.6 to PH 7.8 for both the hemolytic and viridans varieties. Norton[1] says he uses agar with a PH value of 8.1 as a basis for blood agar and obtains excellent results in growing both the streptococcus and pneumococcus. Avery and Cullen[2] used medium having an initial reaction of PH 7.6 to PH 7.8.

Since our work involves study of Strep. viridans, we determined to make an effort to find out whether a medium of one reaction was superior to that of another for growing this particular organism. In our experiments we assumed that the rate of acid production was a fair index of the rate of growth and vitality. It may be that the reaction which favors the most rapid growth will not produce an organism with the maximum degree of virulence. Such indeed, seems to be the case with the diphtheria bacillus, as Bunker[3] found that the most rapid growth of the diphtheria bacillus occurs in a medium having an initial reaction between PH 7.0 and PH 7.5 while the greatest toxin production takes place in a medium having a reaction of PH 7.8 to PH 8.2.

Our results would seem to indicate that growth will take place in medium having a PH value anywhere between 6.4 and 8.0. The index in this was that sufficient acid was produced in all the cultures in 24 hours to bring about the maximum color change in bromthymol blue. Further, all the tubes presented the typical appearance which indicates a growth, and subcultures all grew out in 24 hours.

There is an indication, however, that growth was distinctly retarded in medium which had a reaction more alkaline than PH 7.6, and further, that the most rapid growth was obtained in medium which had an initial reaction of PH 6.8.

The experiments were all carried out in the same way, the only variation being the age of the culture used. As near as we could tell, the results were the same except that when using an older culture the acid production and the accompanying changes in the appearance of the medium will not take place quite as rapidly as it will with a younger one. The organism used was isolated from the root of a tooth, the apex of which had been the seat of infection.

Altho nearly all textbooks, when de-

[1]Am. Jour. Public Health, 1919, 9, p. 190.
[2]Jour. Exper. Med., 1919, 29, p. 215.
[3]Jour. Bacteriol., 1919, 4, p. 379.

scribing cultural characteristics of various organisms, speak of the turbidity or cloudiness and the formation of precipitates in liquid mediums, the reason for such reactions and just what they indicate is not made clear. Altho the student is told that such changes in the appearance of mediums indicate that bacteria are present, he is not always told why their presence produces such a change.

Kendall[4] dismisses the matter by saying that visible changes in the appearance of broth cultures incidental to the development of bacteria are not of great importance, and mentions the fact that they consist essentially of turbidity, sediment and occasionally a ring or pellicle.

It is a significant fact, however, that all bacteria do alter the physical appearance of fluid mediums, and that this fact is always referred to in some way. So important is it that in the fabrication of fluid mediums, clearness is insisted on whenever possible in order that these changes may be the more readily detected.

Like all other living organisms, the metabolic processes of bacteria may be divided into two phases, anabolism and catabolism. In the case of bacteria the catabolic phase predominates.

Any alteration in the composition or appearance of mediums due to anabolic processes are so slight that they can be disregarded. During the first few hours after inoculation the anabolic phase may go on quite rapidly and a slight cloudiness may result in fluid mediums, due chiefly to the rapid increase in the number of bacterial cells.

This phase is rapidly succeeded by the catabolic one and then the greater changes, due to the breaking down of the various constituents of the mediums, take place, and with it the accompanying changes in the physical appearance are noted.

Without going into great detail, since the details have been ably set forth by many, these catabolic changes are divided into two main groups: Those that have to do with the breaking down of proteins and those that are concerned in the splitting up of sugars.

All bacteria do not possess the power to do both, nor can all bacteria split up both proteids and sugars to the same extent. The resultant end products produced by different types of organisms have been studied and used as an aid in identification.

One of the principal end products resulting from the activity of both proteolytic and sugar splitting enzymes is an acid in one form or another. Not only will this acid alter the reaction of the medium, but it will often precipitate substances that were held in solution; for example, phosphates. These precipitates will be the principal factor in the change from a clear to a cloudy medium. Some of the end products are only slightly soluble, and as they are formed they appear as precipitates or suspensions.

All of these changes are important and indicate that an organism is present. The changes are not only due to the presence of myriads of bacterial cells, but also to alterations in the composition of the medium resulting from bacterial metabolism. Eventually the organism may die, due either to the exhaustion of the available food supply or to the liberation of so much in the way of decomposition products that the environment is no longer favorable to its existence.

An analogous change is often noted when adjusting the reaction of mediums. If the medium is too alkaline it becomes necessary to add acid, usually normal hydrochloric, to bring it to the proper point. The addition of such an acid always throws down a precipitate, either at once or on heating. This precipitate can, of course, be filtered out. It is reasonable to suppose that acid produced as the result of bacterial metabolism would also bring about such a change.

It is a significant fact that in the

[4]Bacteriology, General, Pathological and Intestinal, 1916.

experiment herein described, the typical indications of a vigorous growth, such as cloudiness and the formation of a precipitate, only appeared as the degree of acidity approached PH 6.3. Not until they reached this point would a mere inspection of the tubes reveal the presence of a culture. Control tubes of uninoculated medium which were incubated with these cultures did not show any such changes.

The chief source of acid production in our medium is the glucose content. It is shown by Avery and Cullen[2] that the amount of glucose, at least in concentrations between 0.5% and 1.5%, does not influence the final H-ion concentration or to any appreciable extent the rate of acid production. According to their experiment, too, very little acid is produced in a plain or sugar-free broth. The slight increase in acidity which they do show might easily be due to the final sterilization and in no way to the action of bacteria. They do not speak of any control which covers this point.

Our own experiments show a somewhat greater amount of acid produced in plain broth. We inoculated several series of 10 tubes each with a Streptococcus viridans and incubated them for 6 days. The PH value of the broth just before inoculating was between 7.1 and 7.3. At the end of this time the reaction in all tubes was PH 6.6. Control tubes of uninoculated medium incubated for the same length of time showed no change in reaction. This broth was made from beef extract and was reasonably free of sugar. It was not made absolutely so by fermenting with B. coli, however.

TABLE 1

RESULTS OF EXPERIMENTS

Original Reaction before Final Tubing and Autoclaving	Reaction just before Inoculating	Reaction just after Inoculating	Reaction after 3 Hours' Incubation	Reaction after 6 Hours' Incubation	Reaction after 7 Hours' Incubation	Reaction after 8 Hours' Incubation	Reaction after 9 Hours' Incubation	Reaction after 12 Hours' Incubation	Reaction after 25 Hours' Incubation	Reaction of Uninoculated Tubes after 25 Hours' Incubation
	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
5% ascites, 0.2% glucose, PH 6.4	6.4	6.4	6.4	6.3	6.3—	....	....	....	....	6.4
5% ascites, 0.2% glucose, PH 6.8	6.8	6.7	6.6	6.3—	....	....	....	....	....	6.6
5% ascites, 0.2% glucose, PH 7.2	7.3	7.3	7.3	6.7	6.6	6.4	6.4	6.3—	....	7.3
5% ascites, 0.2% glucose, PH 7.6	7.6	7.6	7.4	7.2	6.9	6.6	6.3	6.3—	....	7.6
5% ascites, 0.2% glucose, PH 8.0	8.0	8.0	8.0	7.8	7.8	7.8	7.8	7.8	6.3—	8.0
1% glucose..... PH 6.4	6.4	6.4	6.4	6.3—	....	....	....	....	....	6.4
1% glucose..... PH 6.8	6.7	6.6	6.7	6.3	6.3—	....	....	....	....	6.6
1% glucose..... PH 7.2	7.0	7.0	6.6	6.4	6.3	6.3	6.3—	....	....	7.0
1% glucose..... PH 7.6	7.4	7.4	7.4	6.8	6.8	6.4	6.3	6.3—	....	7.4
1% glucose..... PH 8.0	7.4	7.4	7.4	6.8	6.9	6.6	6.4	6.3—	....	7.4

PH 6.3— is used to indicate the maximum color change in bromthymol blue.

CONCLUSIONS

While there may not be a great deal to choose between PH 6.4 and PH 7.6, a broth given an initial reaction of PH 6.8 will favor a more rapid growth, while a broth having a reaction more alkaline than PH 7.6 will distinctly retard growth. Between the 5% ascites, 0.2% glucose broth and the 1% glucose broth there appears to be no appreciable difference when growing a pure culture.

PSYCHOLOGY IN ITS RELATION TO PRACTICE

By ALFRED PAUL ROGERS, D.D.S., A.M., Boston, Massachusetts

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

PSYCHOLOGY is essentially the study of man's thoughts, feelings, and motives, and if rightly undertaken will be of immense interest and value to us. But, nevertheless, the experiences that come to us during the daily pursuit of our practice are in essence largely psychological because they have to do with the thoughts, feelings, and motives of our patients, ourselves, and those nearest to the children who are under our care. For the dentist as well as the physician some knowledge of practical everyday psychology is essential to the successful conduct of his practice. By attention to this subject not only shall he attain greater success for himself but he shall also be of greater service to his patient. It will hardly be necessary for the student of dentistry and its various branches to study psychology in the academic sense, nor is it necessary for him to perform personal experiments in a psychological laboratory. It should suffice if he were to familiarize himself with the findings of men who are recognized specialists in this important branch of science. Here and there, perhaps, a student will find in the works of these men certain ideas which may be adapted to his particular work. For the dentist there seem to be many opportunities for the employment of certain psychological principles, which principles the successful practitioner sometimes applies without his knowledge. Their employment seems to be natural to him, and if you were to analyze the routine of his daily mental efforts you might surprise him and please him, too, by pointing out where he had made use of certain psychological principles, much to his patients' advantage as well as to his own.

The dentist comes into very close contact with the mental attitude of his patient. In some instances, at least, it is quite essential that he have knowledge and skill in directing the thoughts of his patients away from harrowing things to more pleasant and useful channels. His understanding of human nature should be such that he quite naturally becomes the director of the thoughts and feelings of those who are immediately under his care. For the orthodontist these things are especially true, by reason of the fact that the orthodontist more often than the general practitioner has to deal with more than one mind. Whether we like the idea or not, we must recognize that most minds are more or less under the control of other minds. *All people are susceptible to suggestion—some more than others.* The orthodontist finds this true of the child, whose susceptibility to suggestion is a marked feature of his life. A child comes to the office for the first time with preconceived notions invariably received by suggestion from his elders or from his playmates. One of the orthodontist's first duties, therefore, is to learn without undue questioning what these mental

attitudes are, and when found unfavorable to the proper conduct of his treatment he must make efforts to improve them by supplying new suggestions which will tend to overcome those of an unfavorable nature which the patient has received.

The essence of the whole situation will be found in the mental attitude of the operator himself. If he has the proper control over his own mentality, he will usually be found equal to every emergency. He will not give evidence of mental anxiety or of nervous fear in the presence of the patient who comes to his office for consultation. I recall my impressions when the first man of national reputation walked into my office with his child. I was neither very old in years nor in practice when this valuable experience came to me. I must confess that upon this occasion I was somewhat perturbed lest I might show the limits of my knowledge in the presence of this great personage, whom I expected to ply me with searching questions requiring concise and scientific answers before he would be satisfied to allow me to undertake the delicate work which was necessary for his child's welfare; but to my great delight and comfort I found this man of reputation in reality a great man, for by his presence and the modulations of his voice he at once put me at ease. Altho his questions were to the point, they were simple, direct, and easily answered. This was one of my first lessons in the value of the proper mental attitude for smoothing the way for those around us and for arriving at correct understandings and conclusions.

I soon recognized after this experience that the secret of success among really successful people seemed to be that mental poise which to most of us comes only with experience. As this great financier had placed me, a nervous practitioner, at my ease, it ever after became my endeavor to secure a similar mental quietude for my patients at the first opportunity. It appears to me that this is the first essential for any practitioner, if he is to establish correctly the first step in the successful treatment of a given case. The busy practitioner is called upon many times daily to exercise this mental attitude, but there are stories which occasionally reach each of us which give convincing evidence that there are many practitioners, even among the older and more experienced of us, who have not yet fully mastered this lesson. An attitude of mind which gives evidence of nervousness, agitation, abruptness, inconsideration, haste, or inattention, is sure to place the patient in an uncomfortable frame of mind. This applies particularly to women and children and those who are not in a good state of health. Children are particularly sensitive to adverse influences of this nature. Let it, then, be a principle to formulate and follow that *the first essential in a successful practice, from a psychological standpoint, is a well-balanced, thoughtful mind giving expression of consideration, of kindliness, and of a desire to be immediately of service to the patient.* This must be accomplished without overmuch ostentation or that objectionable suavity of manner which is sometimes noticeable among professional men. The best way to cultivate the truly professional frame of mind is to strive to nurture, in every act of life, the essential attitude of unselfishness, and a desire to be of service for the patient's own immediate good and not as a means of self-aggrandizement. Those who labor for profit alone no doubt in many instances become very proficient in their work. It is a necessary attitude of mind, but it must not be divorced to any great degree from that more altruistic idea of service. In studying psychological problems in re-

lation to practice, it must not be forgotten that there are other influences in and about the office which should be under restraint and proper guidance. The secretary, the nurse or assistants should be instructed in the principles of service. By no unkindness should they displease or offend the patient, no matter what peculiarities he may exhibit. When the office force is thus instructed to work with harmonious endeavor, the operator's task is much easier in dealing with the various types of children.

It is quite natural for me in a talk of this kind to refer most frequently to the treatment of children, because for years the study and treatment of little people have absorbed my attention to the exclusion of almost everything else, and I am sure my hearers will pardon me if I leave them to draw their own conclusions and make their own comparisons in applying these principles to the treatment of older people.

One of the most important problems that come to the orthodontist or dentist in his daily practice is the management of the nervous mother and child. Let us consider these two who have decided upon a visit to the orthodontist for a consultation. In all probability the child's malformation has been discussed in his presence at home. Various children of the neighborhood who have been under treatment by more or less skilled practitioners have been cited either as instances to encourage or to discourage the attempt. Sometimes the harrowing tales of Johnnie Jones's experiences while having his teeth treated have been told. The anemic, wide-eyed child of eight or nine years is very susceptible to the influence of these details, and when the proposition is made to visit the doctor he and the mother approach the dreaded office with nerves on edge and with a mental attitude of dread. It is when such a patient enters the office for the first time that he is most susceptible to suggestion. If the things he dreads are absent—and, mind you, he is looking for the dreaded things—if he is disappointed in not finding them, the first step toward successful treatment has been accomplished; but if perchance the little patient meets another coming from the operating room in tears, or while waiting for his turn to come his heart is pierced by shrieks of pain, his first impression is extremely bad, his fears have been confirmed, and his dread and timidity have increased a hundred fold.

Earlier in this paper I suggested that the mental attitude of the operator and all his assistants be such that all is pleasing and the child's mind is diverted, at least temporarily, from its unhealthy channel. An aid in accomplishing this may be found by having the reception room made attractive for the child, so that if his sojourn there is at all prolonged he will have something to occupy his mind, something to please his fancy. His reception by the operator should be wholesome and easy, lacking a studied effort to please. Frequently the first remark of a mother of the type we are considering is that her child is very nervous and that she has difficulty in controlling him. It has been my practice to meet this suggestion with a counter-suggestion tending to impress upon the child's mind that his nature seems to be to carry with it evidences of sterling worth and courage, that I am sure no experience will come to him during his treatment that will in any way place a strain upon his fortitude. After the first brief visit, during which nothing particular is accomplished in the way of operative procedure, I endeavor to have a talk with the parent in the absence of the child. It is well under such circumstances to ask the parent if she understands the nature of suggestion and the strong influence

it exerts upon the mental and physical development of her child. It is well to point out that the career of the child may be marred by repeated incorrect suggestions. All parents wish their children to be healthy and strong and to grow in courage and judgment, able to meet successfully the vicissitudes of life. It is only thoughtlessness which allows the mother so to hamper her child by incorrect suggestion that she weakens its character, and she very readily appreciates the value of good, strong, helpful suggestions. Usually after an interview of this nature one hears very little of the nervousness which is supposed to be present, and dread soon disappears. The child becomes courageous and thoughtful, and this type, as you all know, becomes the most satisfactory and easily treated. There are many variations of instances, such as the above, and it is not my purpose to attempt to cover them all, but this is given more particularly as a suggestion of the possibilities of the first contact with the patient. On the other hand, if this type of child receives the least inconsideration, if the operator in his over-anxiety to make progress with the case overlooks this first fundamental of a proper psychological condition, the efforts to obtain even a start are prolonged. Agitation and suffering are increased, the child's confidence in the operator is not what it should be, and the treatment very often results in failure. While this type is sometimes difficult and fairly common, it does not by any means constitute the greatest problem of the orthodontist.

There are many other types of children with whose attitude it is hard to deal. They are not nervous children as we understand the nervous child. Our problems with the active, dynamic child are quite as difficult to overcome. Sometimes he is meddlesome, sometimes rude and boisterous, sometimes thoughtless, neglectful or ignorant, lacking grace and consideration, and sometimes he is arrogant, spoiled, stubborn, and bashful. These characteristics of the child must be handled with a degree of skill that rearranges or controls his mental attitude during his presence with the operator. I may say assuredly that a strong and proper influence brought to bear upon these types of children will in many cases have its effect not only during their presence in the office but may also often influence their behavior in other situations and in other places. The dentist's work is particularly important when it is with children. His mission is not merely a saver of teeth or a corrector of malformed jaws or undeveloped faces, but his influence should be of such a character as to establish habits of thoughtfulness, habits of cleanliness, habits of courageous and courteous conduct. Whether he realizes it or not, the dentist occupies the position of a teacher, and the teacher is essentially a psychologist whose efforts should always be made for the improvement, at least to some degree, of the mental attitude of those who come under his care.

To be of the greatest good and to accomplish the finest quality of service, the dentist must be in sympathy with all phases of childhood and its activities. The parent who complains of the restlessness or the boisterousness or the dynamic qualities of his child is a poor parent. The dentist who is perturbed or agitated by the lively activities of his little patient is losing one of the essential elements of his success. Some children are extremely active. Some male types have an insistent and uncontrollable desire to meddle with things of a mechanical nature. Upon the first acquaintance these types will often make attempts to play with the mechanical apparatuses which are so attractive to them. It is essential that the operator use skill and forebearance in the treatment of these children. Some mothers are frequently heard to

scold and admonish their children, saying, "Jack, leave that alone; you'll bother the doctor," and sometimes the visit is punctuated by a succession of "dont's" from beginning to end. While I believe in teaching children the proper amount of self-control, I am convinced that it is harmful to restrict their activities to an unnecessary degree. If a child is found to be over-active or over-curious, it is often well to let him satisfy his activity or curiosity, seeing that no harm comes to the child or to that particular apparatus which is absorbing his attention. "The way to kill curiosity is to satisfy it." A generous attitude toward children of this type very often rewards the operator by making a loyal and desirable friend of his patient, whereas by a series of "don'ts" and harsh words he may easily destroy chances for a successful accomplishment of his undertaking. It is rare indeed that the operator has occasion to show resentment, and the parent or nurse, in some cases at least, should be given to understand privately that the operator knows the nature of the child and is in no way disturbed by his activities and that it is not proper nor necessary for her to admonish the child in the operator's presence. Suggestions of this nature should be made to the child in the absence of others.

It may be well before continuing to consider further the susceptibility of children. In order to gain a clear conception of this attribute of the child's mind, it is only necessary to watch him at play and to observe the influences of the varying suggestions which come to him; or another field of observation is open in noting the mental communication which passes between the child, and the parent, nurse, or governess. It will be interesting if we can visualize these suggestions as they flash thru the childish brain and if we can note their varied influences. It takes very little observation to learn that the child abhors negation. Where the negative method of suggestion is allowed to play a prominent part in the child's life, we are very apt to find a more or less docile or uninteresting development, or a disobedient child lacking respect for and obedience to those who should by every right receive his love and consideration. It will thus be seen that it is easy for us to arrive at the conclusion that negative suggestion, while it is sometimes necessary, is a poor means for general use in unfolding or controlling the mind of the child. The continual remonstrance not to do this or that either acts as an irritant upon the nervous disposition of the child or else the child becomes indifferent or inattentive and goes along in his own sweet way. On the other hand, if the suggestions are indirect and positive and their application made with intelligence, you are more apt to find children who are alert and responsive, showing the beneficent results of the wiser methods of discipline. Instead of telling the child not to do this or that, his mind may be diverted by carefully directed positive methods to some other channel which may open to him more promising spheres of influence. There is one principle which it is well to bear in mind at all times when dealing with children; that is *that the mind cannot think of more than one idea at a time, and when concentrated on that one idea, all other things are mentally absent.*

Difficult situations may be successfully avoided by using this method. Even pain of short duration may be overcome by directing the child's attention to some particular object or thing which will hold it until the unpleasant experience is passed.

It is never wise for the orthodontist to make any reference to pain, because the mere suggestion that such and such an operation will not hurt may suggest to

the child's mind a series of doubts and an expectation of pain where such thoughts were absent until he heard the ill-spoken word. Realizing, then, the importance of suggestion, it behooves the man who undertakes the treatment of children to cultivate an accurate, discerning state of mind and, at first, at least, to make his application of these principles with studious care.

There are two words in the English language the significance of which the orthodontist should early realize. Especially is this true if he deals mostly with children. These two words are "*confidence*" and "*interest*." There are many dubious methods of temporarily gaining the confidence of the child, but such methods usually have elements of deceit which are sooner or later discovered by the child. When this discovery is made, be the deception ever so slight, the meaning and beauty of the word "confidence" are no longer his to enjoy in his relations with that particular child. It is, therefore, necessary for us to couple with that word of beauty, "truth"—truth begets confidence, and confidence means trust. If you will reflect upon the significance of these words, their inner meaning and what they really stand for, you will recognize that they symbolize the principles that constitute the foundation of the successful treatment of children.

I think there is little doubt but that everyone is thoroly in accord with what I have already said, realizing that confidence is the foundation upon which our work must be based—that truth and frankness must be the essence of our conduct toward child life. The individual has within him his own God-given talents that teach him best how to approach the child, but the basic principle remains the same with every individual, no matter what his temperament or what his inclinations may be.

In a former paragraph I gave the hint that interest is one of the essential features in securing the proper mental attitude of the child-patient. In some respects children are like adults, and we know that adults in some respects are like children. In my experience I have found children vastly more interesting than adults and, as a rule, vastly more clever. They approach subjects and receive ideas with a clearness of vision and a frankness which are sometimes remarkable. Their intuitions and perceptions are amazingly clear and accurate, and the younger of them are unhindered by a veil of self-consciousness or a desire to appear other than they really are. A child's expression of gratitude when it is spontaneous and not prompted by an elder is most beautiful and genuine, and if his frankness in expressing his opinion could be carried into adult life and accepted in the same sense with which it is given, it would clear away much misunderstanding. Lest I wander from my theme, let us turn again to the subject of attention and how best it is gained and developed. To secure and hold the interest of children, one needs frequently to change the object of his attention. A child as a rule thinks quickly and soon exhausts those elements of interest in any given subject which appeals to him. One must, therefore, keep him thinking actively, but not on any one subject for a length of time. If not a new subject, a new phase of the same subject must be presented to be interesting. There are not many exceptions to this rule. I have in mind a number of children who are capable of conversing at length on a subject that might try the intellect and patience of much older people. One must seek to make the interest of the patient as spontaneous as possible. It may be necessary for the dentist to do some active thinking himself. His efforts must not carry with them the slightest suggestion of being studied or invented for that particular patient, for if the patient once makes this discovery, he begins an analy-

sis of the motives. When this time comes the dentist is immediately placed upon the defensive, and it is necessary for him to direct attention to some other interesting subject. The orthodontist, in his efforts for the children in this particular, must, of course, have some knowledge of the art of conversing with children. Some may fail because of a misconception of what conversation is, but having obtained the right conception one may easily make it an ally if he chooses, or the reverse if he neglects its culture.

In order to converse successfully with children, one must be sympathetic to the proper degree, be genuinely interested in what the child wishes to say, and one must see to it that the replies, whether they are to be in assent, dissent, or interrogation, come not apparently, but absolutely, from a whole-hearted, unselfish interest in the subject-matter of the conversation. One's attention must be considerate, his hearing accurate, and his replies framed in the most interesting manner possible. It is not necessary with these little people always to talk of little things, for great and good things, as a rule, interest them much more. Recently a child who came into my office confided to me her disgust with a saleslady who, when showing certain goods to her, insisted in applying childish and frivolous phrases in describing their excellence and suitability, rather than using terms of honest meaning and showing a proper regard for the intelligence of the child. I have met boys and girls from ten to fourteen years of age who are much more interesting in conversation than many older people in the same station of life. Seldom have I found it necessary in my treatment of children to resort to fanciful tales to secure their interest. Occasionally a wide-eyed, fanciful youngster will be interested by some allusion to the supernatural or to the airy breezes from fairyland, but as a rule the more substantial things interest them to a greater degree. A sustained interest is more to be desired than a temporary one, and the child soon outgrows the fairy-tale stage and looks for something more substantial.

So much, then, for these necessary elementary ideas to which the orthodontist must give careful thought if he is to be absolutely successful in his work.

Let us now attend to what perhaps might be considered by some a more serious feature of the work: the control of habits. This is a field which, if one should devote his entire life to its study, he would scarcely be able to master in all its phases. So intricate and varied is the problem of vicious habits that it is a difficult one to contemplate, but if each one were to add his experiences and record his successes and failures, we might in time acquire more skill in their control or correction. It will scarcely be necessary to designate those habits with which we are chiefly concerned. When we remind ourselves that the muscular draperies of the face are in many children under control (not conscious control of the central nervous system, but under unconscious control of a more or less deranged nervous system), the complexity of our problem to a certain degree will be understood. In fact, the matter, as I look at it now, is so vast that I hesitate at the parting of the roads, not knowing which one to follow. If I were to strike at the center of the matter with as accurate an aim as I am capable, I would say that the first essential in correcting habits of this nature would appear to be to teach methods of conscious control of the muscular and nervous elements. The mind is the seat of our activity, and the afferent and efferent nerves are its agents which convey sensations and directions for action. The muscles are highly organized agents of the mind and should be under con-

scious control of the central nervous system. The child whose habitual use of the facial muscles is faulty is absolutely unconscious of these muscles or their action, is unapprised of the fact that he may by action of the will control these muscles, is unmindful of the fact that these uncontrolled muscles are surely but slowly, and on some occasions not so slowly, working disastrous results upon the delicate osseous framework of the face. Few parents, indeed, have any realization of the fact that the uncontrolled muscles of the trunk are surely if slowly distorting the bony framework of their growing children. *Let me emphasize this point, that conscious control of the muscular system is an essential which every orthodontist must first fully realize, and when he has realized it, study how best to correct the defects and faults of these of his patients who are in need.* It is obvious, then, that to correct any especially bad habit of the muscles it will be necessary to direct the child's attention to the fact that such a habit really exists. By intelligent language, by careful wording, the child, having been brought to the proper frame of mind, must be taught to comprehend and appreciate the harm which is being done to this uncontrolled agency of the central nervous system. Having been instructed to the proper degree of understanding, the task of treatment can then be undertaken, provided the patient has had instilled in his nature an earnest desire to rid himself of the injurious action. Certain methods are then adapted which are best suited to the individual case for gaining conscious control of the facial muscles. This is usually accomplished by instituting certain exercises which involve the mutual activity of mental processes and the muscular action which they control. Of course, it goes without saying that before an intelligent audience, such as I have before me now, that the corrective work of the osseous tissue must be proceeding at this time thru the use of the most simplified orthodontic appliances. After repeated efforts, defects needing eradication are gradually overcome by the conscious effort. New and correct habits are formed, and a patient unconsciously begins to assume the proper control. My object at present is to leave you in a thinking attitude, so that the ultimate good that may be derived will not be because I have related to you a succession of my own experiences, but because I may have stimulated a desire for thought upon your part or perhaps have in some measure established a coincidence between your own observations and mine.

Discussion

Lawrence W. Baker, Boston, Massachusetts: The handling of human nature, the skilful handling of people, is, I believe, regarded as one of the most complex and difficult problems of man and I gather from what Dr. Rogers has said that he has had his difficulties in meeting these intricate problems.

I must acknowledge that I too have had my problems in child psychology. In fact I have gone as far as to attempt to classify these difficulties. First of all, I find that children of divorced parents are the most troublesome. These little unfortunates have lost, usually, the beautiful influence of united parents whose common aim is the welfare of the child and who seek to discipline him thru kindness. Thru lack of this influence arises a spirit of rebellion toward all discipline, including that of the orthodontist. The next group of patients with whom I have difficulty is the rich children who are under the control of foreign governesses. As a rule these women do not understand the workings of the mind of the American child. Still another type of patient which I do not like to see is the child of the neurotic, flighty mother. We all have them and we all know the type. The mother insists on standing right by the chair, under high nerve tension, and tells tales of woe, saying to the child: "Now I am going to stay right here dearie and hold your hand, and when it hurts just squeeze tight." Under this influence no orthodontist can do justice to himself or to his little patient. I wish Dr. Rogers would tell me how he gets these mothers away from the chair, out of the operating room, and out of the office entirely.

I might tell you that I get around some of these difficulties by the use of slight-of-hand tricks and a certain kind of ventriloquism.

This latter gift got me into all kinds of trouble in my early days, but now it stands me in very good stead in diverting the child's mind from himself. But of course we all have our individual ways of winning our little patients.

After all is said and done, the trouble often is largely with ourselves, our lack of good physical condition. Doing this delicate and exacting work for squirming and twisting children is a severe tax on our nervous energy, and when we find we are losing control of ourselves and of our little patients, let us get out in the open, play some good game, and be boys again.

Hugh G. Tanzey, Kansas City, Missouri: There is one point I wish to make in regard to this paper. It seems to me that Dr. Rogers, and I presume the majority of the orthodontists, is giving all his attention, or most of it, to the care of children. During my twenty years' experience I have for many reasons experimented quite a great deal on adults. Early in my career I took them because I thought I could do a great deal in the way of correcting irregularities and also because I thought my family and myself needed the money. Later on I took them because they insisted that I do so, and I felt that I could improve conditions by so doing. In recent years I have come to the point where I am rather leaving it up to them, trying to be conscientious about it, endeavoring to find out to what extent they are interested in and pleased with the work. It does not appear to me to be the right thing for dental practitioners, professional people of any kind, to do merely the little things they like to do because it is easier to do them. I am now getting all the information I can from those adult patients that I have treated and from those I am now treating, and I am aiming to place matters frankly before the prospective adults. There is a peculiar situation that confronts me. Rarely do I get an adult to say that he is not pleased with the treatment or that he would not go right thru with it again, tho at times I am not satisfied and believe that he is not actually telling the truth. But, so far as correcting malocclusion and to a large degree improving the health of the patient is concerned, I will say that it is possible with adults. I think I can prove that from my practice.

Yet it is easier and much more satisfactory to treat the little ones. It is possible to handle children as young as one year. I have not tried any under that. If you think you can handle them all alike, can apply the same principles of psychology to all children, you might as well meet your Waterloo at one time as another, because it can not be done. In taking an impression of the mouth of my year-and-a-half-old baby recently, I found that the psychology necessary was to place her on her mother's lap, and when she squawked to take the impression! When I got ready to take another impression I would go thru the same procedure. I do not think it is always well to make the patient believe that the things he is going to encounter are absolutely pleasant. I do not tell the child that. The way I have been handling boys recently is costing me more than formerly—that is, in the way of extracting temporary teeth. I do not do that because I like to but because I believe it to be my duty. I rarely send a little patient to an exodontist. If a tooth is going to be rather difficult to extract, however, I refer the patient to the exodontist. I hit on the idea of saying to a boy that if he would allow me to extract a tooth without raising a howl, I would give him a dime; if he did raise a howl he would have to give me fifty cents. Under that arrangement, the boys rarely make a fuss at all. On account of the high cost of living, I have raised the dime to twenty-five cents. I have had children come to me and ask me to extract their teeth, which are not always loose. I am just citing this because I think we have a tendency to do the things we like to do rather than that which we should do. I believe, if you go deliberately into cases, determined to do the right thing, you will soon win the parents, which is more important than winning the child, when you consider the difficulties encountered in convincing the parents that you are going to be conscientious.

F. W. Motley, Boston, Massachusetts: The paper just read has been exceedingly interesting to me. I prepared myself primarily to be a teacher before I went into dentistry, and as a result had to have considerable preparation in psychology. I have been very much interested in the way different dentists have handled children in one of our larger institutions here in Boston, or rather in two of the fairly large institutions in Boston. I have noticed with a great deal of pain the lack of very fundamental principles of psychology in many dentists in regard to the treatment of very young, susceptible children. I have recently learned that the dental hygienists of Columbia University are to be given a course in psychology and pedagogy, and I have been speaking with different hygienic dentists in regard to the system and asking whether they thought it would be well to have such a course. I have found almost without exception that they thought it would be very much to their advantage. I think the paper has impressed on all of us the necessity of dentists having at least a knowledge

of the working principles of psychology. I hope that if there are any professors of colleges here they will be able to put these thoughts into action within a very short time, so that no dentists from any schools in our country can possibly get thru without having a good understanding of psychology. No one needs it more than the dental hygienist. I hope this thought may be taken up by those who are in authority in the schools and colleges of our country.

George F. Burke, Detroit, Michigan: The essayist has given us a very interesting paper. It shows that he has studied this subject both from the standpoint of his private practice and in its broader aspect thru reading.

To those who wish to pursue further study in this field I would suggest the reading of such books as *Adolescence,* by G. Stanley Hall; *The High School Age,* by O'Shea; *The Teens,* by King; and *Psychology and Physiology,* by Sadler. *Mother's Magazine* and *Home Life* runs a department devoted to child psychology. Teachers study this subject for the purpose of enabling them to better control those intrusted to their care. Our lives are spent also among children and a knowledge of this subject is of prime importance in caring for many of them, especially the misunderstood or unusual types. Schools giving instruction in orthodontia would do well to give a high-grade, interesting and constructive course in child psychology. It would enable us to get on with children more satisfactorily and greatly increase our sphere of usefulness.

C. Frank Bliven, Worcester, Massachusetts: When I began dentistry, the chief practice of the profession was filling teeth, extracting teeth, making plates, and occasionally regulating teeth. In the past fifty years one can very readily see the advance that has been made. Today dentistry has broadened to such an extent that no man can possibly follow all its branches, and we are necessarily obliged to confine ourselves to one or two. We have now added a new one, that of psychology, and we have listened to a very admirable paper on that subject from the mental standpoint. But to my mind Dr. Rogers' paper failed to reach the fundamental principle, that is, the principle of love. If we have not that principle in dealing with children it is utterly impossible for us to succeed with them for the reason that they are so psychic in their nature, so understanding of our inner feelings, that we may say what we please to them and I doubt if they will believe it. They know themselves that things are wrong. I will give an illustration of a little girl who came to me. We got along very nicely, but as her mother and father thought my fees were too expensive—this was even in the old days, before the high cost of living—they took her to another dentist. Later she began to suffer with a toothache. The father allowed this to continue for a few days, and finally took her to another dentist to have him treat the tooth. He went at the child in the usual way of inconsiderate dentists. When he placed his fingers in her mouth, she deliberately brought her molars in contact with them so firmly that he could not get away, and the father was obliged to slap her before she released them. The father took her home, for the dentist refused to do anything more for her. Finally the girl said: "I will go to Dr. Bliven, but I will not go to that man again." She was finally allowed to have her own way and was brought back to me. I seated her in the chair, reduced the inflammation and capped the pulp, because I wanted to prolong the life of that pulp as long as possible. After the operation the child went into the reception room and I went into the laboratory. There was a connecting door and I could hear the conversation vrey clearly owing to the acoustic properties of the place. The child would speak and the mother would say "Sh!" and then the child said: "But mamma, Dr. Bliven hurts so easy!" I believe I did hurt that little girl just as much as the other man, probably more, because the tears were running down her cheeks during the operation. But I was fond of her, and I think the idea of affection went from me to her, and I was able to do the work without any difficulty owing to her confidence in me. I will give another illustration. A mother brought a boy to me, a boy who was headstrong, rebellious, unmanageable, with whom neither his father nor mother could do anything. The fact was they did not understand the management of children. He did as he pleased, practically, and the mother was in despair. He had a very badly broken-down molar that needed extracting. There was nothing left except the roots, and they were abscessed. The parents had taken the boy to two dentists to get the tooth extracted and the dentists and the boy encountered difficulties. They failed to do anything for him, and the mother finally brought the boy to me. After examining the case and gaining some idea of the boy, I took the mother into the reception room for a few minutes of private conversation. I informed her that it was not the child's fault, but hers and her husband's. They must first learn to control themselves before they could be able to manage their child. They brought their child to me that I might do something that it was impossible for them to do. How did they expect that I was going to manage him if it was impossible for them? Must I hit

him in the head with a club? What could I do? I could not give him gas or anything else. He would not take it. He said he would kick the window out or do anything rather than submit. I asked her to take the boy home and tell him that while she was willing to do anything in her power to help him out of his troubles, he must not come to her or to his father about the matter, but must go to the guest room or to some other room in the house and close the door. There he must stay by himself and decide what he would do, whether he would go on suffering with the tooth or have it extracted. In two days the boy walked into my office and said: "Dr. Bliven, I want you to take this tooth out." I replied: "I am not in the habit of extracting teeth, but I will send you to a man who does." He said: "I want you to take it out." All the will force that had been on the negative side was changed to the positive. I extracted the tooth without the use of an anesthetic for he had made up his mind to have it done whether it hurt or not because it was a brave thing for him to do.

Dr. Rogers: In treating children of nervous parents I have found it expedient to attempt the re-education of the parent. That seems to be the best and quickest way to reach the child because there seems to be a strong nervous reflex between the parent and child. Until the parent has been made to understand, the operator will find great difficulty in controlling this type of child. One speaker referred to the matter of bribing children into bravery. It has never been my practice to tempt a child to do anything for a bribe. The fact is I would not take a bribe myself and I feel that the child should be taught to stand upon his own feet, to cultivate a courage of his own, and to learn to do things because they should be done and because it is right that they should. A reward may perhaps be looked at in a different sense. A reward comes without expectation because one has done a certain thing in the right way or has acted properly. A bribe is something that is offered to a person to do something that he would otherwise not do. You can understand why I eliminate entirely this sort of thing from my practice. If you can obtain the right mental attitude and teach the child to see the things in the right light, bribing is never necessary.

Another speaker referred to the fact that I did not mention love and its influence in controlling children. A little reflection would have shown that I did mention the attributes of love, truth, kindness, confidence, and trust. One may train himself to habitually act in accordance with the principles of kindliness. It then becomes quite natural to treat an unlovable child in such a way as to gain his confidence annd trust. Thus the whole matter works out better than might otherwise be the case. I was glad to have Dr. Burke speak on the subject because he said some things I would like to have said myself. I think psychology should be placed on the curriculum of the dental schools, but the trouble is in finding a psychologist who understands our problems. It will be best for us to study, observe, and finally evolve our own psychological literature. In this way I believe we shall be more apt to establish ourselves upon the right basis. It was interesting to hear from Dr. Motley who, having had training as a teacher, is in a position to speak with authority upon this subject. What he said encouraged me greatly. Some of us go thru life engaged in daily practice scarcely giving thought to the importance of the subject of psychology. Undoubtedly the more skilled one becomes in the use of psychological principles the more useful he will be.

A METHOD AFFORDING DENTURE SERVICE IMMEDIATELY FOLLOWING EXTRACTION

By ROBERT R. GILLIS, D.D.S., Hammond, Indiana

(Read before the National Society of Denture Prosthetists, August 20, 1920, and the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

WE FREQUENTLY meet with patients for whom it would be highly desirable to provide dentures immediately after we have extracted their natural teeth.

Such patients by reason of their pride in personal appearance—their reluctance "to be seen without teeth"—are willing to pay for the extra service involved in supplying them with dentures during that intervening period between the time of extraction and the time when the alveolar ridges are sufficiently dissolved when we may reasonably expect more permanency in the fit.

Men and women alike often make a desperate effort to retain badly diseased natural teeth just because they dread appearing "toothless" among their business and social associates.

In the light of our present knowledge concerning the subtle evils of oral foci of infection, our present effort is made with the hope that we may thereby remove the patient's last argument for the retention of diseased teeth.

The man of common labor or the shopkeeper whose work compels him to appear daily before his customers and converse with them; the woman whose duties in an office or schoolroom afford no leisure time during which she can go into retirement while waiting for teeth; all busy people, as well as those persons of leisure whose social duties only are most to be consulted, appreciate our efforts to keep them dentally presentable.

In these modern times of stress and strife, "strep and staph" have created a condition that will compel a revision of Skakespeare's Seven Ages to the extent that the one qualification "sans teeth" applied to his seventh age should be moved forward several lines and placed just after "sighing like a furnace"—for I can imagine nothing that makes a person sigh more than to be told he must loose his teeth.

Thru the method herein offered, we would make possible one further revision of Shakespeare's classic by eliminating entirely the words "sans teeth." Nobody now needs to appear sans teeth at any stage of life.

Nothing original is claimed for the system here described.

We have selected the several steps in procedure from various methods and tried to assemble a technic that is adaptable to all cases.

For many years, a few dentists, having extracted all the molars and bicuspids previously, have aimed at like results by making impressions of the ridges and teeth and registering central occlusion before extraction of the front teeth; recovering the casts; trimming off the teeth; then setting up and vulcanizing dentures over these modified casts. That method is accurate only to such degree as the operator is a good guesser for he must trim the gingival contours by guess only.

Where pyorrhea has caused consider-

able recession of the gums, such an approximate method may succeed fairly well.

Or, in a case presenting normal gum and ridge conditions, fair success may be attained by grinding the necks of the front teeth to fit the ridge and not attempting to make a labial rim of vulcanite on the denture. We know from experience that dentures made without labial rims do not afford the same degree of efficiency as those made with complete rims.

The method herein offered makes it possible for us to construct a denture within a few hours after extraction that will afford greater efficiency than is possible from the older methods of making a denture from impressions made before extraction.

Preliminary Study of Case

When the prospective denture patient first appears, we should immediately begin a close examination of conditions, studying the patient's features to determine all the facial peculiarities.

In talking with the patient, note the variations of action in the two sides of the face as to the movements of the muscles of expression and mastication. You will be surprised to observe the asymetrical conditions in most adults.

Observe to what degree the natural gums are displayed when the patient smiles and laughs; note the position and contour of the lips when the mandible is at rest; the length of the teeth in relation to the lip lines; and any peculiarly atypical arrangement of the teeth. All these observations are to be made while the patient is entirely unconscious of your close scrutiny.

The writer has found no field in dental service wherein the patient and family and friends are so free to offer criticism as in denture service.

For this very reason, in anticipation of criticism, to forestall any unjust criticism, and to avoid future misunderstandings, we have found it to be to the mutual advantage of patient and operator to reach a thoro understanding on several points before the natural teeth are disturbed.

When it is agreed and determined that we are to go thru with the case, we make and record some measurements and make some impressions from which casts will be made for future reference.

Measurements

With a metric rule, measure the distance from the angle where the nose and lip meet in the median line to the incisal of the maxillary central. It is well also to measure the distance from the angle at the alae of the nose to the cuspid incisals.

With these measurements, you will be able to restore these dimensions in your denture—or make such variations as have been agreed upon previously.

Now measure in the median line from the nose-lip angle to the lower border of the chin; in this dimension, make two records, first with the teeth in central occlusion and second with the mandible at rest. There will be a variance of from 1 to 6 millimeters between these two positions for with the mandible at rest, the teeth are not in occlusion.

These measurements enable us to re-establish central occlusion for the case insuring against making the occlusal rims either too long or too short.

In those cases where the natural teeth are much in evidence, in smiling or laughing, we measure also the width and heighth of the exposed gum area. This record should be made also upon one of the reference casts of this case.

All these measurements should be recorded for future reference.

We next pass a small straightedge or bar across the maxillary teeth just back of the cuspids and ask the patient to close the mandibular teeth against the bar so as to hold it steadily in place while we observe whether it is parallel to a line drawn thru the pupils of the patient's eyes. Any variance should be

noted. This bar should be parallel with the eye-line. If any variance is evident, call the patient's attention to it at this time.

Our next step is to make a record of the facial contour along the median line. At first we used a piece of 12 gauge lead-fuse wire; but this proved rather soft and too easily altered so we now employ a 14 gauge aluminum wire.

Straighten out a piece of wire 12 inches long. Holding one end on the head in the median line just above the hair line, carry the wire under pressure against the forehead, down between the eyes and to the tip of the nose. Bending the wire with the fingers or suitable pliers, conform it to the tip of the nose, lips and chin.

When finished this wire contour gauge, rested lightly along the median line of the face, should be in contact thruout its length but not impinging or depressing the tissues at any point. This wire is then laid upon a piece of bristol-board and its shape marked along the inside with a pencil. Cut carefully along the mark and the result will be a silhoutte of our patient on the one side and the cutout portion will serve as our contour guide for future reference.

This card also becomes the proper place on which to record all the other data bearing upon the case.

A second contour gauge may be likewise shaped with wire beginning at the lobe of one ear passing forward on the face on a level with the fullest contour of the upper lip and terminating at the lobe of the opposite ear; still another transverse guide may be indicated in some cases, passing from ear to ear just below the alae of the nose.

The measurements thus far made will enable us to locate the artificial central so that its incisal shall be a definite distance from the nose—lip angle in reproduction of the natural dimensions. How may we be able to locate it definitely anterio-posteriorly in the sagittal plane or median plane so that it cannot be too far forward or too far back as judged by the location of the natural central?

Our profile guide solves this problem. Adjust it to the face; hold the metric rule in such a way that one corner touches the median incisal of the central incisor while the rule lies against the cardboard. Maintain this position while a line is drawn across the end of the rule and down along the side. This line is our landmark to which we may come back any time with the same rule and thus re-establish by its inner corner the exact location of the natural central. Likewise it gives us a means of checking up when setting the porcelain teeth so there can be no error where duplication is sought in position.

The use of this profile guide alone probably eliminates more guesswork on the dentist's part and more complaint from the patient than any other feature of this whole system.

Preliminary Impressions

We now take a small roll of softened modeling compound; have the patient shut the teeth in central occlusion, relaxing the lips; place the compound over the front teeth, (covering about to second bicuspid on each side), bring the lips over the compound and then with a napkin over the lips press and burnish the compound against the teeth and gums. Remove when stone cold and you have an impression from which you will secure a cast-relief of the labial appearance of this patient's teeth.

The next step is to make sectional impressions of the upper and lower jaws and teeth. These are made in trays having no buccal or labial flange. We use compound again for the impression material. The teeth, after extraction, are set into their respective imprints in these sectional impressions and models are secured therefrom that will accurately reproduce the characteristic features of that natural denture.

While making these preliminary stud-

ies and measurements, and impressions we have discussed with the patient his several peculiar features and mutually agreed upon what features shall be reproduced and what ones altered or modified in the prosthetic denture. This is the time for the dentist to anticipate the necessary changes and inform his patient as to why such changes are necessary.

The selection of teeth for the case comes next.

In the selection of teeth, I find all patients reasonable when we have their own natural teeth as a guide. Ofttimes it is desirable to have another member of the patient's family or some close friend assist in the selection of teeth. Seldom does a case present that requires any special diplomacy at this stage.

With these preliminary steps complete, we are ready to proceed with the operation for removal of the teeth and preparation of the ridges to better receive our dentures.

Extraction and Alveolotomy

We will detail an application of the method to a case requiring removal of the maxillary teeth and alveolotomy and the making of a restoration to occlude with the natural mandibular teeth.

Anesthetic

The anesthetic of choice for this surgical operation is procaine employed in the nerve-blocking methods.

Any general anesthetic may put the patient into a condition that precludes our proceeding with denture construction immediately after the surgical work is done.

Removal of Teeth and Alveolar Process

When the parts are thoroly anesthetized, the teeth and adjacent soft tissues should be cleared of all foreign substances by using gauze or cotton sponges; sprays of antiseptic solution; washed over with 60% alcohol; and then painted with menthol-iodin solution.

In order that we may keep the parts in good condition while operating, it is advisable to divide the whole field into sections and operate upon them as consecutive steps. Do not attempt to cover too much territory at one step. It is better that we should take only four or five teeth for one step and do this much thoroly and in a cleanly manner rather than to attempt making a complete extraction before trimming any of the process.

When the teeth and adjacent soft tissues have been made ready for the operation, our first instrument used is the lance. Make a clean incision continuous along the labial or buccal gingival border of as many teeth as have been selected for the first step; then make a like incision in the linguo-gingival border.

These teeth are then carefully extracted. If any root fragments break off and remain in the process, do not attempt further to remove them now but wait until the later stage when the tissues are opened wide and ready access afforded.

In the next step, we carefully lift the labial and buccal mucoperiosteal tissue beginning at the incised gingival border, lifting it up from the process so far as we have predetermined the process should be removed.

What determines how much process should be removed?

Just two considerations:—contour and pathology.

You will remove no more than will permit the necks of the porcelain teeth to be placed in the desired position and permit a labial border for the denture; you will remove enough to obviate objectionable contours; you will remove whatever is *necessary* to eliminate pathology.

It is seldom ever necessary to disturb the lingual mucoperiosteum.

Alveolotomy

With suitable bone-cutting forceps or ronguers, we then remove the boney septa between the alveoli and then the labial or buccal plate of process to a distance

extending from half to two-thirds the depth of the alveolus. Once in a while a case presents wherein it is necessary to go beyond the apex of the alveolus; but such cases are unusual.

At this stage of the work, we must be on the lookout for pathological conditions. We have X-ray films to guide us in this work and we now fail to be surprised to find conditions worse than the X-rays indicated.

Some operators make extensive use of chisels, others employ bone burs and stones for the removal of the process. I have had best success with a suitably shaped ronguer. With this instrument, we first bite out sections with a labio-lingual cut and then go over this edge with a mesio-distal cut. This mesio-distal cut is for the purpose of smoothing the alveolar rim, freeing it of any minor points or projections. The same trimming or smoothing may be accomplished with an antrum rasp or a heavy bone curette or bone burs or stones. Our preference is for the instrumentation that leaves the minimum of fragments and bone debris in the field of operation because we wish to avoid the necessity of irrigating the parts. Irrigating and flushing the field frees it from debris but, in our humble opinion, it is not beneficial to the tissues that are to remain.

With your first step or area completed to this stage, continue to the next and the next until the entire jaw is operated in the features described above.

The lingual border of process is likewise smoothed off but not reduced materially.

A study of many cases for months after the operation, with such changes as progressively come to some of them, convinces me that the surgeon who reduces the lingual alveolar borders errs in proportion as he reduces them. Some operators apparently forget that another dentist must follow them with denture construction when healing is complete, and their enthusiasm carries them so far in tissue removal that the result can be called by no other name than wanton destruction.

It has been our good fortune to be our own follow-up dentist so we have studied methods and results from both viewpoints.

One must not formulate the idea that this surgical technic will result in a foundation for a denture that positively will not change after the denture is worn for a short time, we have not attained that millennial state yet. Such a happy result seems to have been reached in perhaps 20 per cent of the cases operated but in the other 80 per cent from one to three relinings will be necessary within a year. To whatever degree pyorrhea is the cause of tooth loss, progressive atrophy of the ridges is to be expected.

Experience in relining has taught us that whatever change occurs will be evident in the buccal side of the ridge (and labial) and the lingual or palatial changes only enough to accommodate the falling crest of the ridge.

We would advise that in the operation of alveolotomy "the lingual rim of process should be merely smoothed off but not reduced materially."

The gum flaps, whose edges were freshened by the lance prior to extraction, are brought back to place and approximated. If any considerable quantity of process has been removed, the labial and buccal flap will be too long; it will overreach the lingual border. Observe the distance it overreaches and with surgical scissors remove the surplus tissue. At this stage, aim to prepare both flaps so that when sutured together they just reach each other nicely to close the wound in an even clean line, having neither a stretching nor a flabbiness of the labial flap.

Horsehair, used with the continuous suture, has been most satisfactory in our practice.

The several steps of surgical proce-

dure thus hastily outlined offer us a great advantage in that we are now able to set the necks of our porcelain teeth into a position formerly occupied by the natural tooth neck; and furthermore we also gain room for a labial rim of vulcanite.

By the older methods, we would wait for months for the dissolution of this labial and buccal alveolar border and, even after patient waiting, be compelled at times to set the teeth in a rather forward position and dispense with the labial rim on our denture. As long as nature takes away this process ultimately, we might as well anticipate nature by removing it surgically, thus hastening the time when our patient can be comfortably equipped with artificial dentures.

Immediate Impressions

When the surgical steps are completed, we take any one of the ordinary impression trays that will fit to the mouth so that the rim of the tray will reach well up to the reflex of the lip and cheek attachments and clear all the ridge tissue. In the heel, the tray must pass the tuberosities and extend slightly onto the soft palate. Thus it is a trifle larger in all dimensions than our finished dentures will be.

Dry the tray and warm it; then with stick compound lay on a bead of compound just inside the rim of the tray and extending entirely around the periphery labial, buccal, and heel. Dip into water heated to 160° to soften the compound uniformly and pass into the mouth. Let the seating of the tray be guided solely by the middle finger held in the median line well back on the tray. The rim of soft compound comes into contact with the tissues above and beyond the operated areas and affords a well-fitted rim. A small roll of black carding wax such as our vulcanite teeth are mounted upon will serve the same purpose nicely and is readily adapted to the tray.

A hole is now drilled thru the vault of the tray with a No. 4 bur; a plaster wash is placed in the tray and carried back into place in the mouth, as in the Hall method. Our well fitted rim would make difficult the escape of surplus plaster as the tray approaches its maximum seating. This little hole in the vault of the tray affords a vent for the excess plaster.

As the impression is complete we then examine the vault with considerable pressure of the index finger to determine the location of any hard parts. These areas should be relieved by scraping the impression just made.

Paint the impression with separating medium and pour with plaster of Paris.

This impression and cast secured from it are only approximately correct; so it is permissible to use plaster of Paris and add potassium sulphate to hasten the setting.

In five minutes, we can shave off the impression plaster and recover the cast.

Over this preliminary cast, we warp a baseplate of material that will withstand the heat of the mouth.

For this purpose, S. S. W. Ideal baseplate has been found very satisfactory. Trim the plate to the approximate limits of the proposed denture.

Shape a piece of 14 gauge stiff wire to the vault contour and extending from tuberosity to tuberosity. Heat the wire and apply it to the hard baseplate, imbedding it in the wax. This wire stiffens the base and prevents its being warped in the later steps.

Carry this baseplate to the mouth and test it for rim heighth as accurately as can be done with open mouth inspection and determine that the length in the vault is satisfactory. We desire the baseplate rims to be about one millimeter lower buccally and labially than the finished denture; we desire the baseplate to extend four millimeters back onto the soft palate between the tuberosities.

Usually this baseplate will be sufficiently well fitted so that it will retain its position in the mouth unaided.

RE-ESTABLISHING CENTRAL OCCLUSION

Have the patient close the lips and swallow with the baseplate in the mouth, coming to a rest position of the lips and mandible when the act of swallowing is done. Following the Greene-Supple methods for re-establishing central occlusion, we direct the patient to retain this rest position of the mandible while we part the lips with our fingers and observe how much space is between the baseplate and the mandibular teeth. This space is to be filled with ordinary baseplate wax. Add this wax to the hard baseplate just as we ordinarily build up occlusion rims—except that for our present purposes we desire a little excess in the length occlusally.

The occlusal plane and length and fullness of wax form is now established in the mouth by the steps and procedure employed in the Supplee method of impression making.

Having first trimmed the wax form approximately with a knife, warm its occlusal surface to a slight depth; return into the mouth; have the patient close the lips and swallow.

If the expression of the lips is tense and drawn, have them swallow again and bite. Often this step must be repeated warming the occlusal surface of the wax before each effort and trimming off the surplus afterward, so that only the indentations of the occluding cusps are evident in the occlusal surface of the wax. Be sure at all times to maintain a flat occlusal surface in the wax.

By reference to the record of our preliminary measurements and to the study casts, we can now determine to a nicety when we have reestablished the desired central occlusion and fullness of contour. Remember that the patient's upper lip is not a safe guide just now for it is still anesthetized and is longer and thinner than normal. This fact emphasizes the necessity of having some other guide such as is afforded by our records previously made.

When satisfied with the re-established relation of maxilla and mandible and fullness of contour, we are ready to proceed with the setting in of the teeth.

In arranging the teeth, we begin with the first molar on one side, cutting out enough wax to allow it to set into position; then set the opposite first molar.

As these teeth are put into approximate position one by one, we return the baseplate to position in the mouth and bring the mandibular teeth into central occlusion. This enables us to place each tooth most advantageously.

Following the first molars, next place the bicuspids and then the second molars, if the space is ample. If crowded for space, we grind and set the second molars after all the other teeth are in place.

With the bicuspids in place on both sides, it is time to proceed with the front six teeth, arranging them to suit the space, occluding teeth, and aesthetic sense of yourself and patient.

As each tooth is arranged to satisfaction, we have found it advisable to secure it in place with some harder wax, like Kerr's setting-up wax. This gives more assurance that the arrangement will not be spoiled while setting subsequent teeth.

All the teeth are now in position on the wax base plate and we wax up the lingual practically to a finished model and wax the labial and buccal so that the desired contour will be complete almost to the rim of the baseplate.

When necessary our baseplate may now be post-dammed by means of a little roll of black carding wax applied across the heel, warmed, and pressed to position in the mouth. This insures a perfect seal in this part of the denture—a thing just as important as perfect rim fit thru the balance of the periphery of the denture.

At this stage, we resort to the plaster of Paris wash again. We convert our base plate with the teeth set up on it,

made from an open mouth impression, into an impression tray with which we secure a closed mouth impression under slight occlusal stress.

From this point forward to completion, the procedure is nothing different from that which any good, careful denture technic teaches.

Trim the plaster impression from tuberosity to tuberosity just as you desire the finished denture to be; we pour this impression with Brophy's Artificial Granite which is a material that sets as quickly as plaster and which is claimed to be free from expansion or contraction. Complete the waxing, having first removed any excess plaster from lingual surface and outer rims; flask, pack, vulcanize and finish "as all good dentures should be."

Before dismissing the patient, one further precaution can be taken to prevent a damaging collapse of the temporomandibular articulation. Warp another baseplate on your approximate cast, reinforcing it with wire across the heel. Now build the occlusion rim with modeling compound instead of wax—and you have thus made something which your patient may wear several days (if necessary); and I have known patients to chew food on this base.

You have given your patient a denture that he can wear today and maybe for months or years with now and then the usual trimming to accommodate new pressures and stresses as he becomes more and more accustomed to the new device.

You have not compelled him to go about for weeks with a wrecked articulation which results always in a damaging of the capsular ligament in an effort to rest the mandible or masticate food; you have relieved him of much misery that is suffered because of cramping of the muscles when without teeth; you have obviated the forming of the bad habit of protruding the mandible in masticating—a habit most edentulous patients acquire in a very short time. Your patient after just a few hours of toothless retirement, can appear again and attend his business or social duties without embarrasment. Your patient will *not* suffer as much from sore gums while wearing this denture as he would without it and in a few days he will have a better ridge than he would have had under old methods after waiting weeks or months.

The expressions of comfort that the patient experiences are most gratifying. Nearly every patient after 24 hours is convinced that he is more comfortable with than without and right there the greatest difficulty is passed for the denture prosthetist. Whenever your patient realizes that his personal comfort is increased by keeping the denture in his mouth, that patient will readily learn to use the denture.

Please bear in mind also that the patient has not had time to forget how to use teeth; normal mandibular control has not been lost; improper habits of mandibular movements have not been formed. The transition from natural denture to prosthetic denture is surprisingly easy.

For yourself, you have eliminated the use of any articulator except the *one best one,* which is the patient's own temporomandibular joint. On it, you can open or shut the maxillo-mandibular relation without fear of creating an incompatible relation between articulation and occlusion. You can make an arrangement of teeth that is harmonious in all respects and a more accurate duplication of nature's organs both as to form and position.

Oliver Wendell Holmes said: "The dental profession has embellished and prolonged the reign of beauty. It has added to the charm of social intercourse. It has lent perfection to the strain of eloquence—and has taken from old age its most unwelcome feature."

The methods above outlined have obviated that "most unwelcome feature" from all ages.

WHAT SHALL WE TELL THE PEOPLE?

By REA PROCTOR McGEE, M.D., D.D.S., Pittsburgh, Pennsylvania

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

THE most difficult part of any story is the beginning. Every life is a romance, but there are few novelists, because there are only a few who know where to start in the telling. Whether the audience is waiting to hear us or whether our message must draw the audience, makes little difference. If the audience waits and the message is uninteresting, there will be few listeners at the end. If there are few at the beginning and the story has the right appeal, the hall will be crowded at the finish.

If we believe that the mouth is the barometer of health, let us say so. We should tell the people that clean healthy mouths are seldom found among those who are below par physically. We should call their attention to the fact that healthy, happy rosy-cheeked children, are the children who have clean, white, serviceable teeth— not those with mouths full of decayed teeth with putrescent pulps that harbor millions of pathogenic bacteria. We should tell them that mastication is of vital importance. We have only begun to scratch the surface of the hidden truths of diet, but we know that the basic principle of nutrition is good food properly digested, and between good food and good digestion there must be thoro mastication.

The people ask, "When is the best time to begin the care of the teeth?" There is only one answer covered by one small word—*now*. *Now* is the time to begin the care of the mouth and of the teeth. Now is the time to begin any effort that is directed toward the preservation or recovery of health. Tomorrow is the enemy of health. Whatever is worth doing is worth doing *now*.

If you would put into words the splendid ideas that pass thru your brain upon the hygiene of the mouth, those ideas would be doing their duty. Whenever you fail to write or speak the gospel of good teeth and good health you are doing a passive injury to your community.

All of the important things of life depend upon the health and energy of the individual. We must tell the people over and over again the danger of oral neglect. We must tell the people what the mouth does in health, what the teeth mean, how important the saliva is in the chemistry of digestion, how the saliva does its work, and the meaning of mastication.

We have five special senses: sight, sound, taste, smell, and touch. The sense of taste is sadly interfered with in a mouth full of cavities reeking with fermentation, a mouth pouring pus from pyorrheal pockets, a mouth with teeth and gums so sensitive that mastication is impossible, a mouth that has only enough teeth to punch holes in food, a mouth so filled with artificial substitutes that it resembles a knight in armor. Taste is the sense that instinctively causes proper mastication. It is one of the great five that were given to us for our preservation. Anything that interferes with taste interferes with digestion. Thru the Eustachian tubes and the pharnyx, we have a direct connection from the mouth with the sense of sound. Thru the teeth the physical property of bone conduction is most acute.

The deaf are enabled to hear thru

bone conduction by resting a sensitized metal fan against the teeth. Is it not reasonable to believe that the sense of hearing is always less acute after the teeth are lost?

Thru direct infection of the maxillary sinuses, thru malposition of the teeth and thru the ever-present odors of decomposition in septic mouths, the sense of smell is partially or totally lost.

The mouth bears a direct local relation to these three special senses—tasting, hearing, smelling. Among the great dangers of oral sepsis are eye complications, ranging from slight conjunctivitis to total blindness.

And last the sense of touch. The whole range of sensory nerves combine to produce the sense of touch. Is there any complication that cannot be either produced or aggravated in the sensory area by a diseased mouth?

I believe we are justified in telling the people that if they wish to preserve their five special senses, the place to start is with the mouth. The constitution of the United States guarantees to every citizen the right to the "pursuit of happiness." Is a citizen pursuing happiness with a mouth full of decayed teeth?

We should tell the people that every child has a right to demand protection from preventable disease. Almost all diseases of the mouth and teeth are preventable. They are preventable by personal and by dental care. Decay of the teeth, loss of the teeth, and the malocclusion alter or destroy facial symmetry, interfere with digestion, rob the organism of normal energy, prevent comfort, encourage disease and disrupt the orderly progress of the individual toward health, success and a long life.

The human interest in the story of dentistry can be made to grip the attention of every listener and of every reader. We have novels and plays where the heroine is beautiful but whose human interest centers in affliction. She may be blind, deaf, dumb, insane, crippled, sick, rich, poor, noble, criminal, but never toothless. Society demands teeth. All of the twists and turns of the imagination will be read with interest except one. Heroes and heroines may trample upon every accepted standard except the dental standard. When they lose their teeth they must either become villains or retire.

We do not have to exaggerate to create public interest. All we have to do is to tell the story simply, plainly. The average reading intelligence is in the first year of high school. Tell the things that will hold the attention of an intelligent high-school Freshman and you have the world by the ear.

Discussion

L. G. Mitchell, Washington, D. C.: For our premise we will accept as truth the statements of our eminent men, surgeons, pathologists and research men of authority, regarding the relation of bad teeth to disease. We do not say they are infallible, but they represent the best in their respective fields of endeavor in the great work of health conservation and the saving of human life. The difference of opinion as to remote causative factors of disease is but natural when we consider the multiple causes of disease and compare our present knowledge with that of but a dozen years ago. But there is no difference of opinion when we consider constructively the importance of normal teeth and mouth in their relation to health conservation.

This is the phase of publicity which I think we should stress. There is so much to say on the constructive side of this great health question, so many reasons why the teeth should be kept clean from babyhood on, why there should be proper diet, which means, of course, a well-balanced one. This form of oral hygiene publicity is especially applicable and is certainly indicated when presenting the subject to children.

We recognize that it is unscientific, at least from a psychological point of view, to hold up the picture of disease as a result of bad mouth conditions; yet it seems necessary to do so when talking to older people, for we have to deal with the very stubborn factors which we will designate as the habit mind, apathy and a general disinclination to do that which requires extra time and effort. People should not have to be scared into doing things for their own good, but we have found it to be necessary. They must be told that

which we find necessary in order to arouse them to their obligation, not only to themselves, but to their children.

In the slow evolution of great reforms, where we have to combat habit, custom, and prejudice, we should not consume a decade or two in accomplishing things which may be done in two or three years. Active education of school children, logical reasons for this to parents and civic clubs of business men, arousing public sentiment so that constructive and protective measures may be secured thru legislation, and cleaning up our own dooryard are in my judgment some of the essential features of a constructive publicity campaign. In order to obtain the desired results we must have the co-operation of parents and business men for the dental school clinics. In order to do this we must tell them the truth, at least as much of it as seems necessary. A number of our scientific men seem to agree that most of the diseases are of infectious origin and that the mouth is the most common situation of this source.

Quoting from Dr. King's classics, "Solving the Oral Hygiene Problem," and his quotation from Dr. Charles Mayo, we find food for serious thinking by all professional men. Dr. Mayo said "that the great masses of people of this generation would not die from one of the great plagues, as they have in times past, but would die from a simple infection; that ninety out of every one hundred probably die because of some simple infection, the result of the focal infection, which focus itself would give them no trouble; the largest part of this was from the mouth."

I want to emphasize that for just a moment. In talking with both Dr. Mayo and his brother Will Mayo, these men told me it was their practice in their great clinics in Rochester, to X-ray the teeth of all incoming patients, unless there was an emergency case in which an immediate operation was indicated. They want the system free from infection if it is possible.

The actual knowledge of each individual dentist regarding mouth abnormalities and their resulting influences on the human system, and the knowledge of conditions which actually exist thru the country bring to light one of the most serious of all national problems with a corresponding responsibility resting largely upon us. I have examined the the work of thousands of dentists in various parts of the United States and I have tried to collect information from the X-ray men and supervisors of unit buildings and the results are astonishing and not complimentary to the dental profession.

"What shall we tell the people?" If a serious illness, say, typhoid, menaces an individual or a community, the physician tells the people just what to do and what not to do to protect the individual and the community. This is not only his business but his duty. The law recognizes the importance of this as a general health measure. We also are conservers of health, the guardians of the health of our people, and when our profession will be few years older we too will, no doubt, be governed by laws made to safeguard the health of the people. At this time we should be governed by the great law of common interest in humanity which, we are supposed to acquire with our professional degree.

A patient goes to a dentist for professional service. His very presence says to the dentist: "I have selected you from all the dentists in the city as one in whose knowledge, skill and honesty, I have all confidence, to give to me the best your profession has to give." If you find the condition which, in the light of modern research, is detrimental or liable to become detrimental to that patient, from whatever cause or source, that patient is certainly entitled to your honest judgment, even tho it involves the feelings of some other dentist. A desire to shield another is most praiseworthy and to be commended, but this spirit should be subservient to your professional duty to the patient and must take precedence over all other considerations. There is no doubt in my mind that there are thousands of people suffering as a result of mouth infection and many others in their graves because of this attitude, a disinclination to place the best interest of the patient first and above all other considerations.

A general publicity campaign in harmony with that outlined by Dr. King in the June number of *The Journal* (1920), with special stress on the lecture feature and that of diet, is the correct plan for the National Dental Association to follow.

In a paper by Dr. Seccombe[1] he emphasized the great importance of learning something about diet and teaching it to our patients. Simply cleaning the teeth no longer guarantees freedom from caries. We must pay more attention to this subject of diet. We must realize that the great problems of the nation are to be solved by the children in the schools.

Let us put ourselves in a position to get close to the school children. If we do this, we will finally get to the realization of the basic principle of the philosophy of life, which is service to others.

[1] *Jour. Nat. Dent. Assoc.*, LVIII (June 1921), 441.

REPORT OF TABULATING COMMITTEE

To the President and Members of the National Association of Dental Examiners:—Your Tabulating Committee presents herewith its 11th annual report, being a tabulation of the first examinations held by the several states dental boards for the year 1920.

Dr. Friesell has also tabulated the reports. Our results have been compared and are identical. The report is hereby submitted without comment. I wish, however, to again request all state board secretaries to send me reports of each examination as soon as completed.

RESULTS OF TABULATION OF STATE BOARD REPORTS FOR GRADUATES YEAR 1920

State	College	Total Number of Graduates	Total Number Examined	Examined Passed	Examined Failed	Percentage of Failures	Number of States Examined In
California	Univ. California College of Dentistry	14	14	13	1	7.1	1
	College P. & S. Dental Dept.	16	14	11	3	21.4	1
	Univ. of So. Cal. College of Dent.	20	19	13	6	31.5	1
Colorado	Colorado College of Dental Surgery	11	10	7	3	30.	3
Dist. Columbia	Howard Univ. Dental Department	36	18	8	10	55.6	9
	Georgetown Univ. Dental Dept.	11	9	4	5	55.6	4
	Geo. Washington Univ. Dept. of Dent.	13	13	9	4	30.8	3
Georgia	Atlanta-Southern Dental College	11	10	6	4	40.	2
Illinois	Chicago College Dental Surgery	92	67	56	11	16.5	8
	Northwestern Univ. Dental School	33	30	26	4	13.4	4
	Univ. Illinois College of Dentistry	12	10	9	1	10.	3
Indiana	Indiana Dental College						
Iowa	University Iowa, College of Dentistry	8	7	7			1
Kentucky	Louisville College of Dentistry	18	16	12	4	25.	6
Louisiana	Loyola University School of Dent.	3	3	3			1
	Tulane University College of Dent.	5	3	3			1
Maryland	Baltimore College of Dental Surgery	26	16	10	6	37.5	6
	University Maryland Dental Dept.	12	11	8	3	27.3	4
Massachusetts	Tufts College Dental School	12	9	8	1	11.2	2
	Harvard University Dental School	22	9	4	5	55.6	3
Michigan	Univ. Michigan College Dent. Surgery	27	27	26	1	3.8	1
Minnesota	University Minnesota Col. of Dent.	65	60	56	4	6.7	3
Missouri	Kansas City-Western Dental College	22	20	20			3
	Washington University Dental Dept.	3	3	3			1
	St. Louis Dental College	8	3	3			1
Nebraska	Univ. of Nebraska College of Dent.	9	8	8			2
	Creighton University College Dent.	3	3	3			1
New Jersey	College of Jersey City Dental Dept.						
New York	New York College of Dentistry	68	61	44	17	27.9	3
	University Buffalo, College of Dent.	13	12	10	2	16.7	2
	College Dent. & Oral Surg., New York	44	44	37	7	16.	3
Ohio	Ohio College Dental Surgery	18	13	8	5	38.5	5
	W. Reserve Univ. School of Dent.	8	8	8			1
	Cincinnati College Dental Surgery						
	Ohio State Univ. Col. of Dentistry	28	28	23	5	17.9	3
Oregon	No. Pacific College of Dentistry	9	5	2	3	60.	1
Pennsylvania	Philadelphia Dental College	18	13	9	4	30.8	4
	Univ. of Pittsburgh School of Dent.	20	20	19	1	5.	1
	Univ. Pennsylvania School of Dent.	43	13	8	5	38.5	3
Tennessee	Vanderbilt Univ. School of Dent.	6	6	6			4
	Univ. Tennessee College of Dentistry	20	19	13	6	31.6	3
	Meharry Dental College	54	47	37	10	21.3	19
	Univ. W. Tenn. Col. Dent. Surgery	6	6	5	1	16.7	1
Texas	Baylor Univ. College of Dentistry	9	8	8			1
	Texas Dental College	26	21	18	3	14.3	1
Virginia	Med. Col. of Virginia Dental Dept.	4	4	4			1
Wisconsin	Marquette Univ. Dental School						
		906	740	595	145	19.6	

SUMMARY

Number of state board reports received	44
Number of state board reports tabulated	44
Total number of applicants examined and passed	595
Total number of applicants examined and failed	145
Percentage of failures	19.6

CUMULATIVE RESULTS OF TABULATING STATE BOARD REPORTS FOR GRADUATES YEARS 1910 TO 1920 INCLUSIVE

State	College	Total Number of Graduates	Total Number Examined	Examined Passed	Examined Failed	Percentage of Failures	Number of States Examined in
Alabama	Birmingham Dental College	54	50	38	12	24.	1
California	University California College of Dentistry	290	120	119	1	.8	2
	Col. P. & S. Dental Dept.	399	136	115	21	15.4	4
	Univ. So. California College of Dent.	473	186	171	15	8.	9
Colorado	Colorado College Dental Surgery	378	359	329	30	8.4	13
Dist. Columbia	Howard University Dental Dept.	302	120	86	34	28.3	24
	Georgetown University Dental Dept.	290	213	161	52	24.4	25
	Geo. Washington Univ. Dept. of Dent.	185	137	108	29	21.2	13
Georgia	Atlanta-Southern Dental College	256	254	239	15	5.9	5
	Southern Dental College	362	337	303	34	10.	10
	Atlanta Dental College	472	441	367	74	16.7	15
	So. Eastern Dental University	2	2	.....	2	100.	2
Illinois	Chicago College Dental Surgery	1480	1234	1010	224	18.2	29
	Northwestern Univ. Dental School	1483	1183	1017	166	14.	34
	University Illinois College of Dent.	353	317	278	39	12.3	20
Indiana	Indiana Dental College	582	557	504	53	9.5	17
Iowa	University of Iowa College of Dent.	616	581	549	32	5.5	14
	Drake University College of Dent.	32	29	29	.....	.....	1
Kentucky	Louisville College of Dentistry	500	438	386	52	11.9	29
Louisiana	Louisiana State College Dent. Surg.	6	.....	.....	.....	.....	.....
	Loyola University School of Dent.	44	38	38	.....	.....	2
	Tulane University College of Dent.	209	158	145	13	8.2	7
Maryland	Baltimore College Dental Surgery	612	433	321	112	25.9	20
	University Maryland Dental Dept.	604	481	353	128	26.6	22
	Baltimore Med. Col. Dental Dept.	83	64	43	21	32.8	12
Massachusetts	Tufts College Dental School	957	808	732	76	10.4	6
	Harvard University Dental School	480	372	321	51	13.7	11
Michigan	Univ. Michigan Col. Dental Surg.	821	738	719	19	2.6	16
Minnesota	University Minnesota College Dent.	734	683	642	41	6.4	9
Missouri	Kansas City Dental College	514	470	434	36	7.6	14
	Washington University Dental Dept.	341	322	311	11	3.4	11
	Western Dental College	456	413	366	47	11.4	18
	St. Louis Dental College	618	555	522	33	5.9	21
	Kansas City-Western Dental College	22	20	20	.....	.....	2
	Barnes School of Dentistry	82	70	55	15	21.4	5
Nebraska	Univ. of Nebraska College of Dent.	200	192	191	1	.5	3
	Creighton Univ. College of Dent.	265	255	246	9	3.5	7
New Jersey	College of Jersey City, Dent. Dept.	57	53	7	46	86.8	1
New York	New York College of Dentistry	1577	1369	991	378	27.6	5
	Univ. Buffalo, College of Dentistry	522	483	364	119	24.6	6
	College Dent. & Oral Surg., New York	988	903	652	251	27.8	4
Ohio	Ohio College Dental Surgery	436	367	273	94	25.6	22
	W. Reserve Univ., School of Dent.	367	342	269	73	21.3	4
	Cincinnati College Dental Surgery	141	114	75	39	34.2	9
	Ohio State Univ. College of Dent.	402	383	345	38	9.9	9
Oregon	No. Pacific College of Dentistry	682	508	409	99	19.5	10
Pennsylvania	Phila. Dental College—Temple Univ.	528	378	287	91	24.	18
	Univ. Pittsburgh School of Dent.	640	613	590	23	3.8	8
	Univ. Pennsylvania School of Dent.	1844	1251	993	258	20.6	20
	Med.-Chi. College Dental Dept.	348	248	176	72	29.	9
Tennessee	Vanderbilt University School of Dent.	385	357	336	21	5.9	19
	Univ. Tennessee College of Dentistry	148	137	125	12	8.8	8
	University Memphis, Dental Dept.	5	4	4	.....	.....	3
	Meharry Dental College	335	276	202	74	26.8	25
	Univ. W. Tennessee Col. Dent. Surg.	21	14	13	1	7.1	3
Texas	Baylor Univ. Dental School	251	172	144	28	16.3	6
	Texas Dental College	135	101	80	21	20.8	1
Virginia	Univ. Col. Med. Dental Dept.	32	30	23	7	23.3	2
	Med. Col. of Virginia, Dental Dept.	147	138	120	18	13.	6
Wisconsin	Marquette University Dental School	588	473	422	51	10.8	11
	Wisconsin College P. & S.	17	17	15	2	11.7	1
		26153	21497	18183	3314	15.4	

SUMMARY

Total number of applicants examined and passed..... 18,183
Total number of applicants examined and failed..... 3,314
Percentage of failures..... 15.4

Respectfully submitted,

T. A. BROADBENT,
Chairman Tabulation Committee,
National Association of Dental Examiners.

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of the
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ASSOCIATION

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Editorial Department

THE VALUE OF A VACATION

Time was when the world moved so leisurely that the necessity of an annual vacation for men and women in the various pursuits of life was scarcely apparent. And that probably was the rational way to live. But we are living that way no longer, and say what we may, we do not wish to live that way. We would chafe under the leisurely life today, and, by the same token, there need be little fear that we will ever be forced into it again. There is an intensity to the affairs of men

in this age that demands every ounce of energy that can be put into them. It is high pressure or—nothing. And who of us wants to register nothing? Not one.

So the issue is clearly before us, and it amounts to this—that since we are a cog in the modern wheel we must play our part and keep up with the procession. If we do this we must work, and work intensely hard. And we cannot work hard all the time. To attempt to do this would not be in accord with the inexorable laws of nature—we must have periods of rest or we will break.

Thus it is that the exigencies of modern life have changed the even tenor of our ways, and forced upon us the necessity of taking vacations. And what a senseless thing it is to attempt to get along without vacations. As well try to run a fine piece of machinery at top speed year in and year out without stopping to let it cool off and get cleaned up once in a while. We know what would happen to the machinery, and if we are logical we know full well what will happen to us if we pursue such a policy.

No dentist can afford to remain in his office constantly and contend month after month with the nerve strain incident to daily practice. It is impossible for any man to conduct a dental practice without a certain amount of tension, and tension tells if it is kept up constantly. Why tempt the fates?

Break away from your work at least once a year, and take that worn and haggard look from your face. Get a complete change of scene and experience, and do things that you are not accustomed to do in your office. Select your own form of recreation, but select some form. Go out and get close to Nature. Lay your weary head against her broad bosom and relax. Breathe the fresh air of heaven, and reach out and commune with the stars. Tramp on the soft turf where every step is a spring, and where the birds are warbling a word of welcome. Let your cheek be fanned by the winds which have filtered through the branches of evergreen trees, and know for once what it is to sleep a dreamless, quiet sleep. Listen to the lullaby of the rain drops on the shingled roof, or pull the tent-flaps tight against a threatened storm. Sit on a log and hear the red squirrel scold in the branches overhead, or watch the chip munk dart along a zig zag fence. Get up at sunrise and see the glory of the coming day. Bow your head in benediction as the purple west recedes into the shadows of another night, and the hush of nature settles over hill and dale.

Think beautiful thoughts, and plan noble deeds. Forget the dross of life, the struggle, the strife, the turmoil. Be a boy once more and drink in the wondrous elixir of hope and enthusiasm, and ambition,

and energy. Go back to nature as your surest haven from the storms of the worldly life, and live again for one brief span that purer, rarer, and happier existence which is the rightful lot of man.

Take a vacation, and renew your lease of life.

SCRUTINIZE COLLECTION AGENCY CONTRACTS

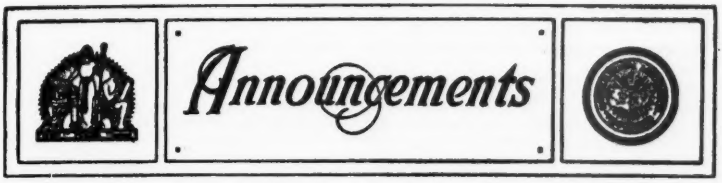
Dentists should be somewhat cautious of collecting agencies if they desire to avoid unpleasant complications. Perhaps the average dentist places nothing but "deadbeat" accounts with collecting agencies, and really does not care what happens, or for that matter whether the account is ever collected or not. The possibilities of getting into serious embarrassment should not be overlooked, for not infrequently the collecting agencies take unfair advantage of their position and place the dentist in an embarrassing position thru misrepresentation. Not infrequently the dentist is made the victim of an unfair advantage thru some such joker as follows:

"In the event the undersigned should withdraw any claims after having assigned the same to said association, the commission thereon shall be paid to said association the same as if said association had collected such claims in full."

It is all right to protect the collecting agencies from withdrawal of accounts immediately after pressure has been brought to bear upon the debtor which results in payment direct to the dentist, but the dentist is not protected if after a suitable length of time there are no results obtained by the collecting agencies and it is desired to place the accounts in other hands for collection. There is no occasion for making a contract that is one-sided in its protection.

GOVERNMENT GIVEN BUDGET SYSTEM

We greet with satisfaction that new step in governmental reform represented in enactment of the federal budget law. Hereafter on the first day of each regular session of Congress a budget will be submitted to Congress, which will have been prepared under the immediate direction of the president, who will be responsible for its recommendations. By the law the present office of comptroller of the currency is abolished and the office of comptroller general becomes effective. Desirable places awaiting good men are those of director of the budget and comptroller general, each paying $10,000 a year. Other evidences of progress in government structure and procedure appear in work of a commission which will recommend to Congress reorganization measures for federal departments.



CALENDAR OF MEETINGS

NATIONAL SOCIETIES

National Dental Association, at Milwaukee Wisconsin, August 15-19.

National Society of Denture Prosthetists, at Milwaukee, Wisconsin, August 1-13, Hotel Medford.

National Association of Dental Examiners, at Milwaukee, Wisconsin, August 15, Hotel Pfister. T. A. Broadbent, Secretary-Treasurer, 25 E. Washington Street, Chicago, Ill.

The Research Commission of the National Dental Association, at Hotel Pfister, Milwaukee, August 14. R. H. Volland, Secretary, Iowa City, Iowa.

Psi Omega Fraternity, Biennial Grand Chapter, August 10, and National Alumni Chapter, August 15, at Milwaukee, Wisconsin Hotel. M. M. Printz, Supreme Councillor, 25 East Washington Street, Chicago, Ill.

Xi Psi Phi Fraternity, Alumni Association, August 15, at Milwaukee, Wisconsin Hotel. J. Emmet Northcutt, Secretary, St. John and Elmwood Avenue, Kansas City, Mo.

Delta Sigma Delta Fraternity, August 15, at Milwaukee, Hotel Pfister. R. Hamill D. Swing, Supreme Scribe, 1623 Walnut Street, Philadelphia, Pa.

Association of Military Dental Surgeons, at Milwaukee, August 16 and 17. G. H. Cassady, Secretary-Treasurer, Presidio, San Francisco, Cal.

Dental Veterans of the World War, at Milwaukee during meeting of the National Dental Association. Harry L. Hosmer, Secretary, Detroit, Mich.

American Society of Exodontists, August 11, 12, 13, at Milwaukee. F. F. Molt, Secretary, 25 E. Washington Street, Chicago, Ill.

American Dental Library and Museum Association, August 15 and 17, at Milwaukee. B. W. Weinberger, Secretary, 40 E. Forty-first Street, New York City.

American Public Health Association, November 14-18, 1921. C. C. Peerce, Assistant Surgeon General, Washington, D. C.

American Institute of Dental Teachers, third week in January, 1922, at Montreal, Quebec. Abram Hoffman, Secretary, 381 Linwood Avenue, Buffalo, N. Y.

Society of American Dental Laboratories, August 16 and 17, at Republican House, Milwaukee.

STATE SOCIETIES

August

Wisconsin; no state meeting because of the National Dental Association meeting in Milwaukee.

October

Virginia, at Richmond, (11, 12, 13, 14).

December

Ohio, at Columbus (6, 7, 8).

NATIONAL ASSOCIATION OF DETAIL MEN

The National Association of Detail Men extend greetings and a most cordial welcome to the members of the National Dental Association attending the Milwaukee meeting to visit their many exhibits, which will be held in Machinery Hall, the best illuminated and best ventilated hall in America. The National Association of Detail Men hold their annual meetings at the time and place of the National Dental Association meetings. Secretaries or exhibit managers of local or state societies, where exhibits are a feature at their meetings, will kindly get in touch with the Exhibit Chairman, H. A. Wilhelmi, M. D., or members of the Exhibit Committee, whose names and addresses will be posted at the Convention Hall. The officers are: president, M. H. Pritchard (D.D.S.), Chicago, Ill., secretary, E. DeLeon Eaton, Chicago, Ill.; treasurer, A. F. Blake (M.D.), New York, N. Y.

THE DENTAL HYGIENE COUNCIL OF MASSACHUSETTS

The Dental Hygiene Council of Massachusetts, in order to develop the knowledge of and interest in oral hygiene, offered during the past school year a first prize of twenty-five dollars and a second prize of fifteen dollars to the undergraduate students at the Harvard Dental School, Tufts Dental School and The Forsyth Dental Infirmary, who submitted the best papers on some phase of that subject before June 1, 1921.

The judges, Dr. William Rice, Dean Tufts Dental School, Dr. Harold DeW. Cross, Director, Forsyth Dental Infirmary, and Dr. Robert S. Catheron, 400 Marlborough Street, Boston, awarded the prizes as follows: first, H. R. Danofsky, Tufts, 1922, subject, "Oral Hygiene;" second, Charles Levinson, Harvard, 1923, subject, "Unhealthy Mouth Conditions and Resulting Ill Health."

ASSOCIATED ANESTHETISTS

American Association of Anesthetists.
New York Society of Anesthetists.
Interstate Association of Anesthetists.
Pacific Coast Association of Anesthetists.
Canadian Society of Anesthetists.
Mid-Western Association of Anesthetists.
National Anesthesia Research Society.

A Bust of Morton for the Hall of Fame—Send Your Contribution Now.

In the election of Dr. William T. G. Morton to the Hall of Fame the allied professions of medicine and dentistry have been singularly honored. By their overwhelming vote the Electors have also evidenced the appreciation of the public at large for the beneficence of anesthesia.

Recently, at the annual dinner of the American Anesthetists in Boston, during A. M. A. Week, Dr. S. Adolphus Knopf, a leading advocate for the honoring of Morton, said it would be a proud privilege for the Associated Anesthetists to place a bronze bust of Morton in the niche assigned him by the Electors. This is to do done on October 16, in celebration of the Diamond Jubilee Anniversary of Morton's first public demonstration of ether anesthesia.

The Associated Anesthetists, as well as other prominent leaders of the allied professions, are therefore urging all those interested to make a substantial contribution for this purpose.

Kindly send your check or money order at once to

F. H. McMechan, M. D.,
Secretary-Treasurer
Lake Shore Road, Avon Lake, Ohio

AMERICAN PUBLIC HEALTH ASSOCIATION

The fiftieth annual meeting of the American Public Health Association will be held in New York City, November 14-18, 1921. Several other activities are planned by the Association in connection with their semicentennial meeting in November, 1921, and it was at the request of the American Public Health Association that the Service institute for next fall was abandoned.

The Service hopes that it will be possible to arrange to hold a similar institute in Washington during the spring or fall of 1922.

C. C. Peerce, *Assistant Surgeon General*

AMERICAN DENTAL LIBRARY AND MUSEUM ASSOCIATION

The fourth annual meeting of the American Dental Library and Museum Association will be held August 15, at 3:00 P. M. and August 17, at the Auditorium, at Milwaukee, Wisconsin. At the first session the official business will be considered and a permanent constitution adopted. The second session will be held on August 17, at an hour to suit the convenience of the majority of members, when an interesting program pertaining to library and museum matters will be given.

The list of applicants for membership in the Association have exceeded our expectations and we trust that all those interested in dental libraries and museums will forward their applications as soon as possible.

The objects of the Association will be the fostering and creating of dental libraries and museums, at the same time bringing about a closer relationship among those interested in the making of dental libraries and museums.

One of the most important functions of the Association will be the means of exchange of dental literature and specimens. Under the exchange the following objects are in view: An exchange of library and museum duplicates, securing libraries, instruments, and specimens of retired or deceased dentists, securing distribution of transactions of dental societies, reprints of scientific papers, and reports of societies, for securing endowments of dental libraries and museums, supplying special information on rare works in single libraries, on library and museum management, technic, device, bindings, etc.

With a view to the further promotion of these objects, the Secretary invites all who have this work at heart to join the Association, either as a society, college, or individual member.

Membership: Any dental society, association, university, college or library, having a permanent home and a dental library. Any

individual interested in dental literature, libraries or museums.

We desire information as to what collections have thus far been made or may be in contemplation, the purpose being to publish later a list of dental libraries and museum workers.

For further information and membership blanks kindly communicate with the Secretary.

A. F. ISHMAN, *President*
B. W. WEINBERGER, *Secretary*
40 E. 41st St., New York, N. Y.

SOCIETE FRANCAISE D'ORTHOPEDIE DENTO-FACIALE

On May 22 the French Society for Dento-Facial Orthopedia was founded, which, as its name implies, is devoted to the study and advancement of orthodontia.

Dentists living *outside* of France may be admitted as *associate* members, providing they take an active interest in that specialty. Their admission may be obtained by submitting an application blank signed by two members of the Society; the application should be accompanied by the amount of fifty francs; the admission is definitive only after a formal vote of the Society.

The officers for the coming year are as follows: president, J. T. Quintero, I, Quai Jules Courmont, Lyon; vice-president, E. Gallavardin, 50, Rue de la Republique, Lyon; secretary, B. de Nevreze, 20, Rue de Mogador, Paris, 9; treasurer, E. Hollande, 6, Rue de Boigne, Chambery, Savoie; editor, P. Ollagnier, 15, Place Hotel de Ville, Saint Etienne, Loire.

The next meeting will take place in Paris, at Christmas time, 1921. All interested in orthodontia are cordially invited to communicate with

B. de NEVREZE, *Secretary*
Paris, 9, No. 20, Rue de Magador

DENTAL CORPS ORDERS FROM WAR DEPARTMENT

Nominations: June 27—Appointment by Transfer in the Regular Army.

To be captain: J. B. Mockbee, from May 22.

Major Charles M. Taylor from duty at Walter Reed General Hospital, D. C., and report to attending surgeon, Washington, for duty.

Captain Hooker O. Lindsey from duty at attending surgeon's office, Washington, to Walter Reed General Hospital, D. C., for duty.

Captain Howard C. Feyler from duty at Presidio of San Francisco to Camp Knox, Ky., for duty.—*Army and Navy Register*, July 2, 1921.

Lieutenant C. S. Ziesel, naval air station, Pensacola, to home.

Lieutenant H. A. Daniels, naval training station, N. O. B., Hampton Roads; to air station, Pensacola.

Nominations: July 7—Promotions in the Navy. C. S. Weigester to be a passed assistant dental surgeon with the rank of lieutenant from August 3, 1920.

The following officers of the N. R. F. to be passed assistant dental surgeons with the rank of lieutenant from August 3, 1920: C. A. Augonnet and E. M. Kenyon.

To be passed assistant dental surgeons: L. F. Snyder, D. L. Chamberlain, G. E. Nichols, E. W. Willett, J. A. Tartre, H. A. Daniels, Hyman Mann, D. L. Cohen, J. F. McGrath, F. D. Clancy, J. J. Haas, D. A. Doherty, A. B. Ward, P. W. Yeisley, H. J. Lehman, H. R. McCleery, E. LeR. Walter, C. V. Rault, E. B. Howell, H. R. Alexander and J. W. Grassl.

Confirmations: July 6—Promotions in the Army: J. B. Mockbee to be captain.—*Army and Navy Register*, July 9, 1921.

Lieutenant A. V. Jolliffe, naval air station, San Diego; to home.

Lieutenant D. P. Taggart, navy yard, Boston; to home.

Promotions in the Regular Army: To be captain, First Lieutenant Arthur Clay Foard, from June 27, 1921.

Major Dale E. Repp to duty at Letterman Hospital, San Francisco, upon completion of present tour of duty in Philippine Department.

First Lieutenant Rollo Town from duty at Fort Leavenworth, Kan., to San Francisco and about September 7 to Philippine Department for duty.—*Army and Navy Register* July 16, 1921.

PATENTS OF INTEREST TO DENTISTS

1335717, Artificial tooth, William Arkin, New York, N. Y.

1338415, Dental appliance, David W. Barrow, Chattanooga, Tenn.

1338068, Dental chart, Alden J. Bush, Columbus, Ohio.

1336345, Dental toilet case, George T. Cornelius, Monessen, Pa.

1337349, Method of and apparatus for producing X-rays, Cornelius D. Ehret, Philadelphia, Pa.

1335825, Tooth-polishing device, William L. Ellerbeck, Salt Lake City, Utah.

1337904, X-ray tubestand and table, Ernest E. Greville, London, England.

1335734, Anterior tooth and backing, Frank C. Hanscom, Elmhurst, Ill.

1336746, Rubber-dam clamp appliance, James W. Ivory, Philadelphia, Pa.

1335987, Dental instrument, James E. Reid, Moorestown, N. J., and C. Kienle, Philadelphia, Pa.

1336390, Fountain toothbrush, J. A. Sargery and O. Dupont, Sherbrooke, Canada.

1335866, Flexible file, George F. Vorhauer, New Brighton, Pa.

1337175, Reversible toothbrush, David G. White, Boston, Mass.

54980, Design, tooth-cleaning and polishing device, G. C. Burlew, Newark, N. J.

54875, Design, Cabinet for X-ray dental apparatus, William H. Thwaites, Grand Rapids, Mich.

1338821, Rotary toothbrush, Max Eisner and A. M. Freeman, Sioux Falls, S. D.

1338918, Dental articulator, Rupert E. Hall, Chicago, Ill.

1338959, Artificial tooth, Leon L. Poston, Council Bluffs, Iowa.

1340115, Fountain toothbrush, Clayton P. Breining, Mill Hall, Pa.

1339812, Dental plate attachment, Israel J. Dresch, Toledo, Ohio.

1339821, Artificial teeth, Rupert E. Hall, Philadelphia, Pa.

1339657, Finishing broach, F. J. Lapointe, Ann Arbor, Mich.

1339711, Tongue-depressor, Jay M. Park, Chaffee, N. Y.

1340089, Removable Bridge for dental work, Arthur S. Stone, Brooklyn, N. Y.

1340093, Toothbrush, James S. Westhafer, Braman, Okla.

1339640, Dental plate or denture, John Williams, Liverpool, England.

55143, Design, Toothbrush-casing, E. H. and E. K. Wiersching, Binghampton, N. Y.

1340760, Rotary toothbrush, George B. Ehrig, Washington, D. C.

1340448, Anesthetic administering apparatus, W. A. Johnson and A. W. Brown, Prince Bay, N. Y., and F. L. Wallace, Philadelphia, Pa.

1340354, Odontometer, Percy N. Williams, Pelham Manor, N. Y.

1341107, Universal dental pliers, Walter G. Bridge, Newton, Mass.

1340959, Dental message tool, William L. Jones, Philadelphia, Pa.

1341191, Dental articulator, Ichigoro Nekahara, Tokio, Japan.

1340908, Dental engine, Oscar H. and A. F. Pieper, Rochester, N. Y.

1342156, Dental educational device, Robert O. Brittain, Boston, Mass.

1341736, Dental cement injection tube, Henry L. Cruttenden, Northfield, Mass.

1342376, Artificial tooth, Samuel Earp, Wallasey, England.

1342280, Electrically-vibrated toothbrush, Patrick J. Fitzgerald, Torrington, Conn.

1342379, Tooth having an interchangeable facing, Frank C. Goodwin, Portsmouth, Ohio.

1341916, Rotary toothbrush, Basil W. Leach, Golconda, Nev.

1341813, Artificial tooth, Melvin E. Merker, New York, N. Y.

1342350, Ear hand mirror, Edward H. Roy, Nashville, Tenn.

1342351, Mouth hand mirror, Edward H. Roy, Nashville, Tenn.

1342521, Protected toothbrush, Kichibei Yanagihara, Sakai, Osaka-Fu, Japan.

1343713, Dental massage and polishing appliance, C. W. Fuller, Yonkers, N. Y.

1343570, Toothbrush, Robert H. Lieberthal, Bridgeport, Conn.

1343691, Dental articulator, William M. Stanbrough, Newburgh, N. Y.

1343240, Pocket toothbrush and dentifrice holder, C. E. Townsend, Norfolk, Va.

55492, Design, tool tray, George M. Taylor, Hartford, Conn.

1344020, Tongue depressor, Coy M. Bugbee, Springfield, Vt.

1344179, Lip guard, Lopezy Diegnez, Juan F. Alcauiz v Bancoupte, Havana, Cuba.

1343935, Method and device for producing plates for artificial teeth, Merritt Rice, Colchester, Ill.

1343949, Vacuum cup fastening means for dental suction plates, George S. Whitaker, Gloversville, N. Y.

1343950, Dental suction plate, George S. Whitaker, Gloversville, N. Y.

1345984, Toothpick dispensing device, Charles H. Bennett, Mount Morris, N. Y.

1345579, Moistening attachment for dental engine handpieces, Ira A. Burnette, Chicago, Ill.

1345433, Crown articulator, Louis Cooperman, New York, N. Y.

1345595, Dental bridge-work, David S. Highkin, Baltimore, Md.

1345606, Dental appliance, James P. Leonard, Joliet, Ill.

1345608, Crown setter, Samuel R. Lewis, El Paso, Tex.

1345939, Folding toothbrush, Converse W. Lloyd, Chicago, Ill.

1345549, Dental appliance, Harry P. Rawson, Minneapolis, Minn.

1345718, Dental mirror, Chester J. Underwood, Elgin, Ill.

1345819, Composition for cleaning artificial dentures and the like, Allan S. White, Washington, D. C.

1346584, Orthodontic implement, Edward H. Angle, Pasadena, Cal.

1346536, Toothbrush, John J. Fitz-Gibbon, Holyoke, Mass.

1346125, Sanitary tooth cleaner, Roy Hasbrook, New York, N. Y.

1346719, Dental crown making machine, M. Ignacio Navarro, Caracas, Venezuela.

55794, Design, porcupine toothpick holder, Aristide Jardella, New York, N. Y.

1347205, Dental flask, Frederic H. Brown, Lebanon, N. H.

1346951, Mold for forming artificial teeth, Thomas F. Glenn, Ardmore, Pa.

1347275, Dental instrument, Eugene W. Iden, Cleveland, Ohio.

1347285, Locking means for orthodontic appliances, F. T. Murlless, Jr., Hartford, Conn.

1346998, Dental appliance, Thomas H. Veale, Camp Devens, Mass.

1347865, Anchor post, Albert L. Melvin, Detroit, Mich.

1348041, Artificial tooth and making same, Edward P. Off, Philadelphia, Pa.

1347555, Dental attachment, Charles N. Reese, Wilmette, Ill.

1348798, Posterior interchangeable tooth and backing for bridge-work, David S. Highkin, Baltimore, Md.

1348799, Posterior interchangeable tooth and backing for bridge-work, David S. Highkin, Baltimore, Md.

1349188, Dental appliance, George F. Du Buque, Los Angeles, Cal.

1342464, Dental instrument, Louis A. Lancit and B. U. Zarger, Newark, N. J.

1349102, Dental ornament, Anderson C. S. Robinson, Suffolk, Va.

1349110, Toothbrush and paste case, William O. Snyder, Veedersburg, Ind.

1349013, Coloring and parting material for dental impressions and molds, William H. Stanley, Montreal, Canada.

1350002, Dental separating or grinding disk, Gilderoy O. Burley, Newark, N. J.

1349832, Dental handpiece, Robert E. Graves, Houston, Tex.

1349767, Rubber-dam clamp forceps, James W. Ivory, Philadelphia, Pa.

1350042, Apparatus for the examination of X-ray and other negatives, Elza R. Stealy, Shenandoah, Iowa.

1349592, Tooth filling, William G. Turner, Brooklyn, N. Y.

1350951, Dental instrument grinding device, Hans Artmaier, Racine, Wis.

1350758, Case for matrix carriers, William H. Welsh, Collingswood, N. J.

56131, Design, Dental cotton holder, Theodore G. Lewis, Buffalo, N. Y.

1351159, Rotary toothbrush, William N. and R. L. Cavileer, Ray, Ariz.

1351623, Detachable tooth, Claude A. Conover, Newburgh, N. Y.

1351108, Dental impression tray, Thomas F. Littlejohn, Plano, Tex.

1351578, Artificial tooth, George A. Louque, New Orleans, La.

1351584, Dental mold-cup, Charles A. Palmer, Seattle, Wash.

1351751, Combination slitter and perforator, Leslie D. Hoff, Newark, N. J.

1352080, Dental casting machine, Felix C. Montuori, Washington, D. C.

1352395, Dental mandrel for holding stones and sandpaper disks, Walter S. Wright, Lompoc, Cal.

1353019, Pulp Canal file, William W. Bolls, Washington, D. C.

1352789, Combined dental mirror and syringe, Joseph E. Craig, Gary, Ind.

1353039, Anatomical bridge articulator, Leon Greenfield, New York, N. Y.

1352614, Suction mechanism for dental plates, John Lehner, Pittsburgh, Pa.

1352995, Dental lamp, Nathan M. Stone, Chicago, Ill.

1353565, Making metallic denture-backings, Robert M. Craig, Wilkinsburg, Pa.

1353467, Device for measuring material for tooth fillings, John F. Fietsch, Forest Park, Ill.

1353587, Saliva ejector, George D. Heck, Prince Bay, N. Y.

1353780, Toothbrush, Matilda Mueller, Rugby, N. D.

1353430, Surgical forceps, Charles J. Sigler, Honey Creek, Iowa.

1353199, Artificial tooth, George H. Whiteley, Jr., York, Pa.

1353942, Dental flask and charger, Delbert A. Aiken, Spokane, Wash.

1354089, Dental tool, Henry Callison, New York, N. Y.

1354454, Dental articulator, James W. Taliaferro, Seattle, Wash.

1354938, Dental plate, Asmus C. S. Angel, Copenhagen, Denmark.

1355037, Toothpick, Edmond Dzink, Toledo, Ohio.

1354696, Tooth-crown fastening, Hans E. Schmidt, Bad Oldesloe, Germany.

1354515, Artificial tooth, John R. Sheppard, New York, N. Y.

1354921, Closure for collapsible tubes, etc., Oscar Sendhelm, New York, N. Y.

1355126, X-ray tube, William D. Coolidge, Schenectady, N. Y.

1355790, Dental appliance, Jacob L. Young, New Rochelle, N. Y.

1355888, Dental abrasive or grinding disk, Gilderoy O. Burlew, Newark, N. J.

1356487, Toothbrush holder, James R. Cluxton, Youngstown, Ohio.

1356352, Dental tool, Feliciano Gonzales, New York, N. Y.

1356372, Dental tool, John L. Kelly, New York, N. Y.

1356401, Anchorage device, Ralph S. Peirce, Hinsdale, Ill.

14961, Reissue, Dentifrice, Meyer L. Rhein, New York, N. Y.

1357024, Collapsible tube and other container, Marcus B. Behrman, New York, N. Y.

1356755, Dental instrument, William W. Bolls, Washington, D. C.

1357063, Bur-stand, Frederick W. Korb, Cleveland, Ohio.

1356731, Means for preparing amalgam for dentists' use, William W. Muchow, Evanston, Ill.

1357285, Toothbrush, Abraham Glatt, Chicago, Ill.

1357289, Interchangeable tooth and backing for bridge-work, David S. Highkin, Baltimore, Md.

1357354, Toothbrush, John Simon, Mason, Tex.

1357601, Apparatus for administering anesthetics, Will P. Walter, Chicago, Ill.

1358523, Fountain toothbrush, Jason T. Cook, Astoria, Ore.

1358300, Dental clamp, Grove E. Dailey, Rutland, Vt.

1358432, Dental drill, Israel J. Fink, New York, N. Y.

1359312, Inhaler for administering anesthetics, Frederick A. Bardwell, Boston, Mass.

1358750, Anesthetic compounds, Oliver Kamm, R. Adams, Urbana, Ill., and E. H. Volwiler, Chicago, Ill.

1358751, Anesthetic compound, Oliver Kamm, R. Adams, Urbana, Ill., and E. H. Volwiler, Chicago, Ill.

1359099, Manufacture of Chloroform, Max Phillips, Evansville, Wis.

56613, Design, amalgam carrier and plugger, Gustav Holtz, Gouldsboro, Pa.

56622, Design, dentist and surgeon cabinet, Charles S. Murlless, Holyoke, Mass.

1359582, Method of and apparatus for backfilling, Lloyd A. Dolton, Chicago, Ill.

1360146, Dental tray, Thomas H. Ragatz, Prairie du Sac, Wis.

1360615, Toothbrush, David A. Bolard, Llanerch, Pa.

1360292, Toothbrush, George E. Hartman, Camden, N. J.

1360778, Motor attachment for use by dentists or barbers, Ernest A. Neel, Ripley, Tenn.

Copies of above patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, Fendall Building, Washington, D. C.

NEW BOOKS RECEIVED FOR THE LIBRARY OF THE JOURNAL OF THE NATIONAL DENTAL ASSOCIATION

The Journal of the National Dental Association promptly acknowledges here the receipt of new publications. Books selected from those named on this list are reviewed below. Reviews are matter-of-fact statements of the nature and contents of the publications referred to and are intended *solely to guide possible purchasers.*

Mouth Hygiene. A Text-Book for Dental Hygienists. Alfred C. Fones, D.D.S., Philadelphia and New York: Lea & Febiger, 1921. 334 pages; 218 illustrations; 8 plates (2d ed.), $5.00.

A Text-Book of Dental Histology and Embryology. Including Laboratory Directions. Frederick B. Noyes, B.A., D.D.S., Professor of Histology and Orthodontia, College of Dentistry, University of Illinois, and Newton G. Thomas, M. A., D.D.S., Professor of Histology, College of Dentistry, University of Illinois. Philadelphia and New York: Lea & Febiger, 1921. 454 pages; 343 illustrations; 21 plates (3d ed.), $6.50.

Handbook of Mechanical Dentistry. J. L. Dudley Buxton, L.D.S., L.M.S.S.A., Dental Surgeon to University College Hospital Dental School, and Assistant Dental Surgeon, West London Hospital, Philadelphia: P. Blakeston's Son & Co., 1921. 269 pages; 168 illustrations.

The American Year-book of Anesthesia and Analgesia, 1917-1918. F. H. McMechan, A. M., M.D., editor. New York: Surgery Publishing Co., 1921. 471 pages; 175 illustrations, $10.00.

Lincoln Life Sketches. In Verse and Prose. By the late Dr. Garrett Newkirk, contains twenty-one sketches covering his whole life, with explanatory notes, and a series of "classic" extracts from his speeches and addresses. New York: Duffield & Co., 1920 $1.25; 47 pages.

A Practical Treatise on Fractures and Dislocations of the Jaws. For Students and Practitioners. Chalmers J. Lyons, D.D.Sc., Professor of Dental Surgery, University of Michigan, Associate Surgical Staff, University Hospital, member of Staff of St. Joseph's Hospital, Ann Arbor, Michigan. Toledo: The Ransom & Randolph Co., 1919. 102 pages. Illustrated.

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